Compressed Air Magazine

AUGUST 1956

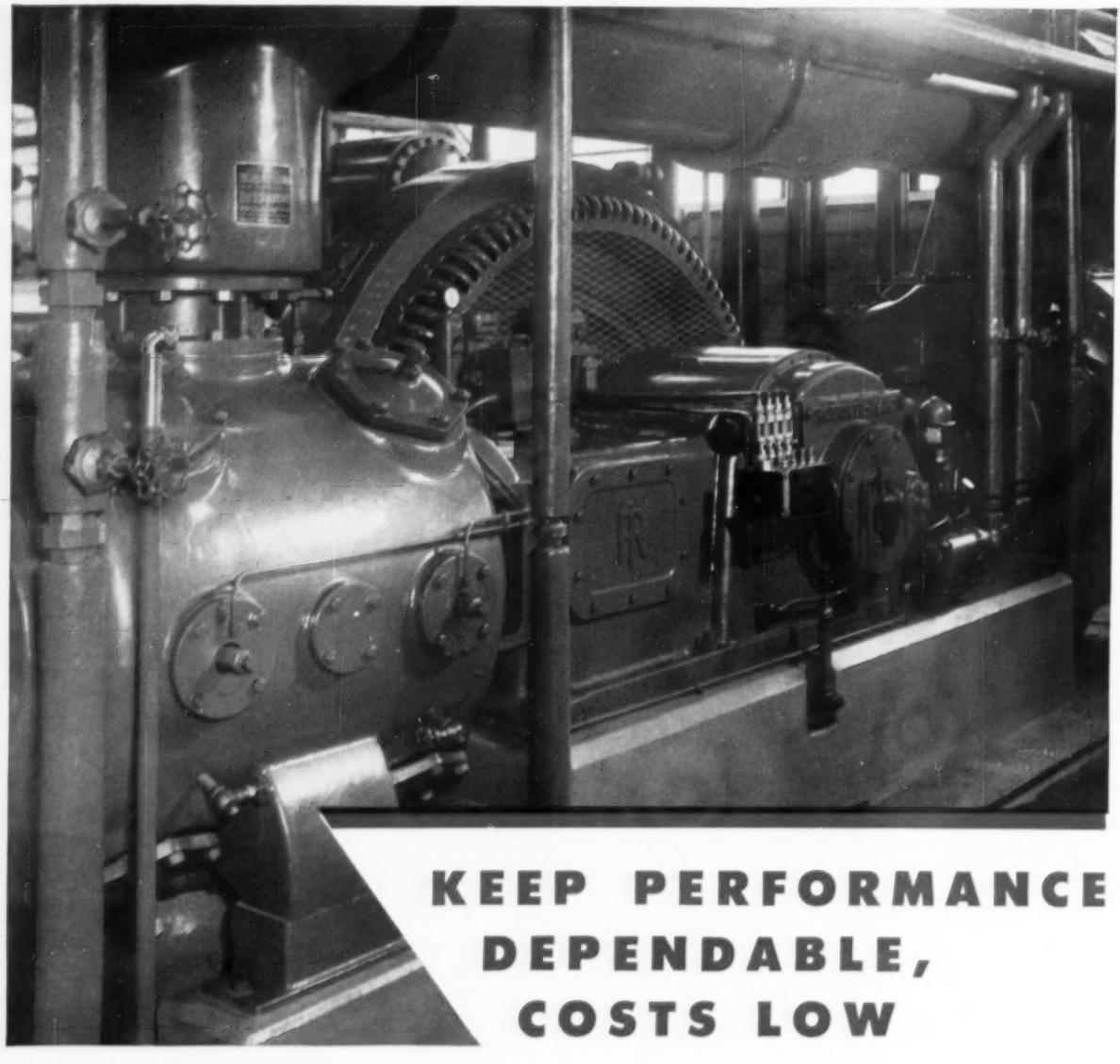
HARVESTER PICKS NUTS OFF GROUND

Experimental vacuum unit being operated in orchard on Hawaiian Islands

(SEE INDEX PAGE)

VOLUME 61 • NUMBER 8

NEW YORK • LONDON



KEEP PERFORMANCE DEPENDABLE, COSTS LOW

WITH *TEXACO REGAL OIL R&O* lubricating your air compressors, you enjoy steady, efficient operation — and keep costs down at the same time.

The reason for this lies in the premium quality of this great oil. *Texaco Regal Oil R&O* is specially made to keep compressor systems *clean*, unhampered by deposits and rust. That means clear lines throughout, free-working rings and valves. These outstanding benefits naturally keep performance high, maintenance costs low.

There is a complete line of *Texaco Regal Oils R&O* — one for every type and size compressor, for any number of stages or pressure involved, for all operating conditions.

A Texaco Lubrication Engineer will gladly help you make the best choice. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R&O

FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS

Circle 1A on reply card

Here is a

Small, Low Pressure

PIPE LINE FILTER

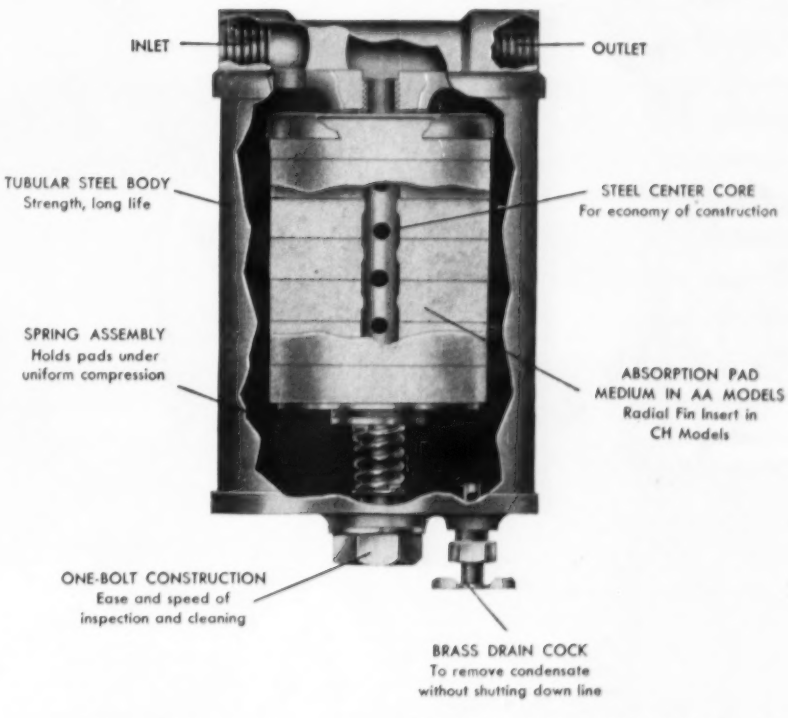
with exclusive STAYNEW *features*

Designed for low pressures up to 40 psi

NOW . . . a small, practical pipe line filter can be specified for installations requiring only 40 psi maximum pressures for compressed air or gas. Staynew's new low pressure models feature greatly reduced weight and improved, simplified construction . . . plus the many outstanding advantages of *all* Staynew Pipe Line Filters.

Properly installed, these Staynew Filters provide long, trouble-free service; removing the last traces of foreign matter, condensed oil and moisture from compressed air or gas lines.

Write for Bulletin 210 describing these low pressure pipe line filters.



TWO TYPES AVAILABLE

1 "CH" MODELS FEATURE RADIAL FIN INSERT. The Radial Fin Insert, in "CH" Models, effectively removes all foreign matter from air or gas passing through it. Larger *active* filtering area insures *lower* flow resistance. The standard medium will remove particles down to three or four microns (.000156″) in size; special media can be supplied for even finer filtration.

2 "AA" MODELS HAVE ABSORPTION PADS. Recommended wherever moisture control is a problem—"AA" MODELS, with fine texture felt pads held under uniform compression—assure removal of the last traces of oil and water from lines. The pads form a deep absorptive mass through which air or gas must pass after initial mechanical cleaning.

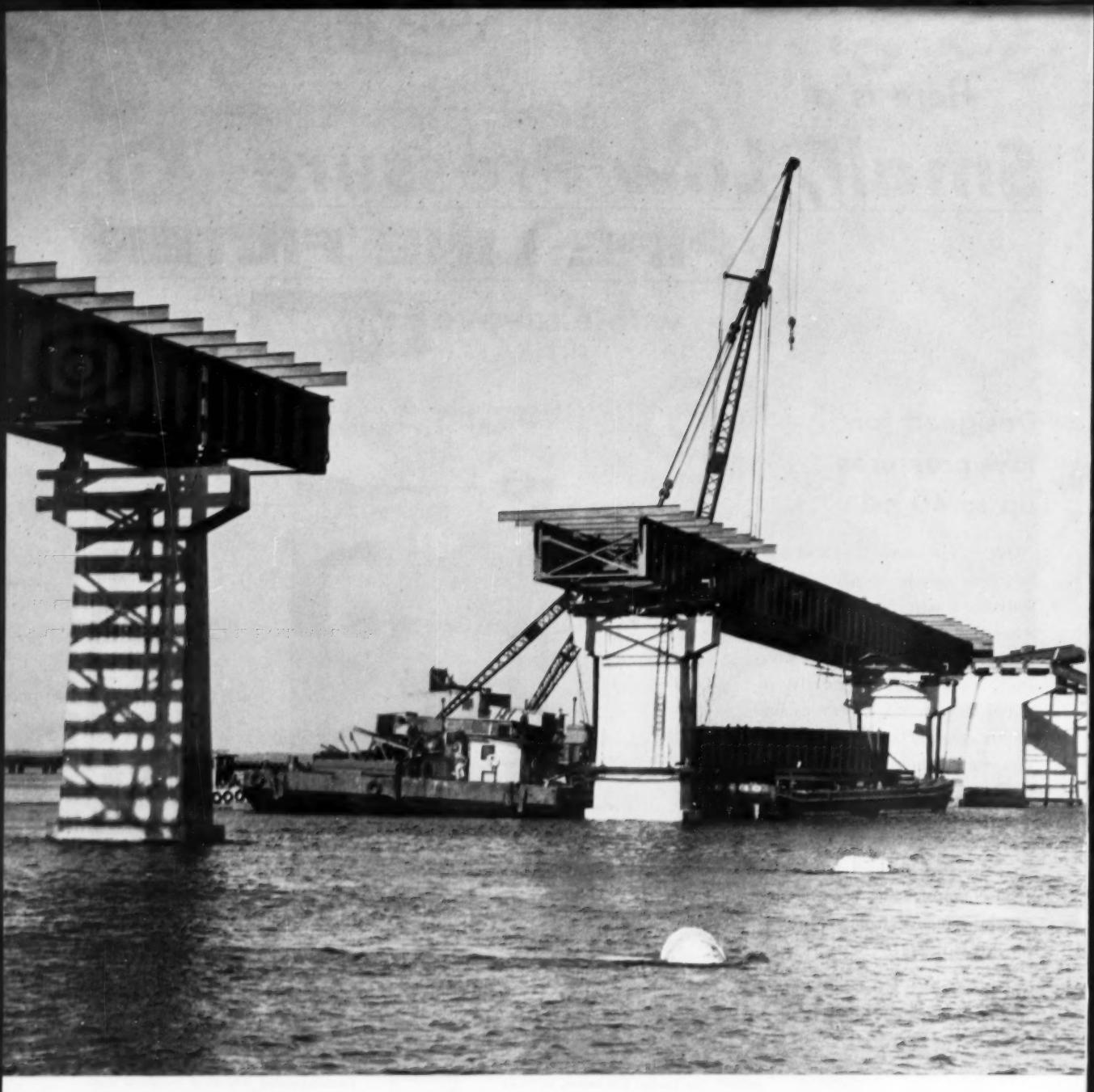
DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

7 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Circle 2A on reply card



Wire Rope at Work—New Jersey's great Garden State Parkway has the incredible total of 282 bridges, and the photograph above shows the last of them nearing completion. It is the Great Egg Harbor Bay Bridge, an impressive span just west of Ocean City. The steelwork, more than a half-mile long, weighs some 2500 tons.

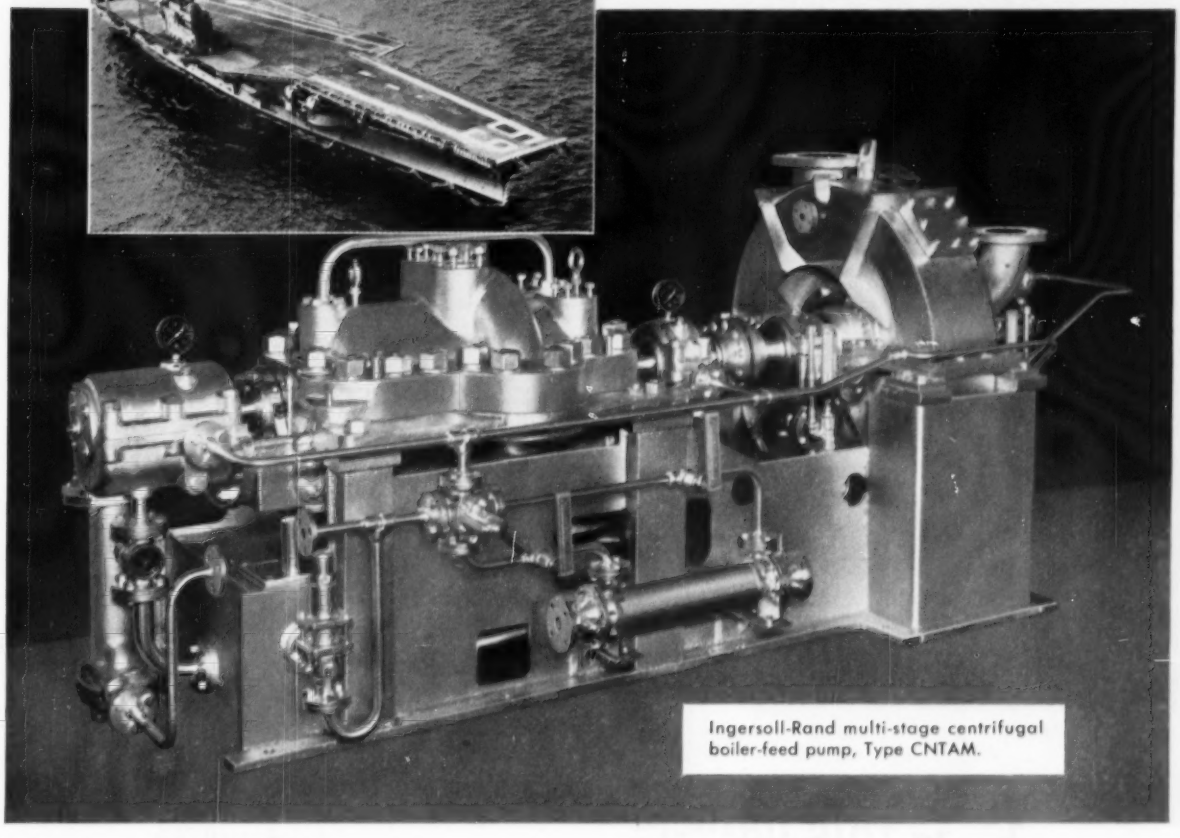
The picture was taken just after two 63-ton girders, completing a 180-ft span, had been erected. The derrick that did the hoisting was equipped with a 90-ft boom, a 43-ft mast, and Bethlehem Purple Strand wire rope. As always in lifts of this nature, a great responsibility rested upon the rope, but the sinewy Purple Strand was more than equal to the job. Taking the loads in stride, it made the dramatic lifts seem routine.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

CONSTRUCTION • EXCAVATING • MINING • QUARRYING • PETROLEUM • LOGGING • MANUFACTURING

USS Forrestal, built by the Newport News Shipbuilding and Dry Dock Co., Newport News, Va., and equipped with I-R boiler feed pumps.



Ingersoll-Rand multi-stage centrifugal boiler-feed pump, Type CNTAM.

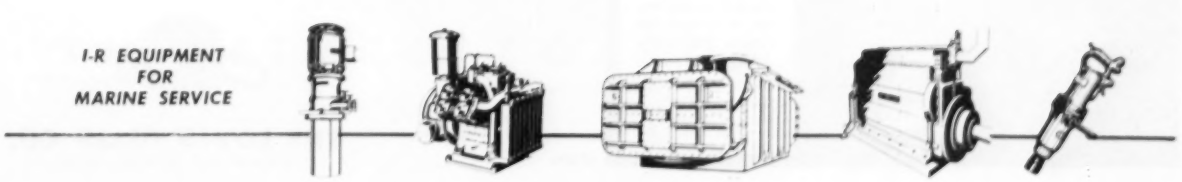
I-R Boiler Feed Pumps on U.S.S. FORRESTAL

For the ultimate in reliability, the USS Forrestal's mighty power plant depends on 12 Ingersoll-Rand boiler feed pumps. Ingersoll-Rand builds a complete line of pumps for the marine industry, to meet most of your applications. For further information, see your nearby I-R representative.

Ingersoll-Rand

10-322 **11 Broadway, New York 4, N. Y.**

I-R EQUIPMENT FOR MARINE SERVICE



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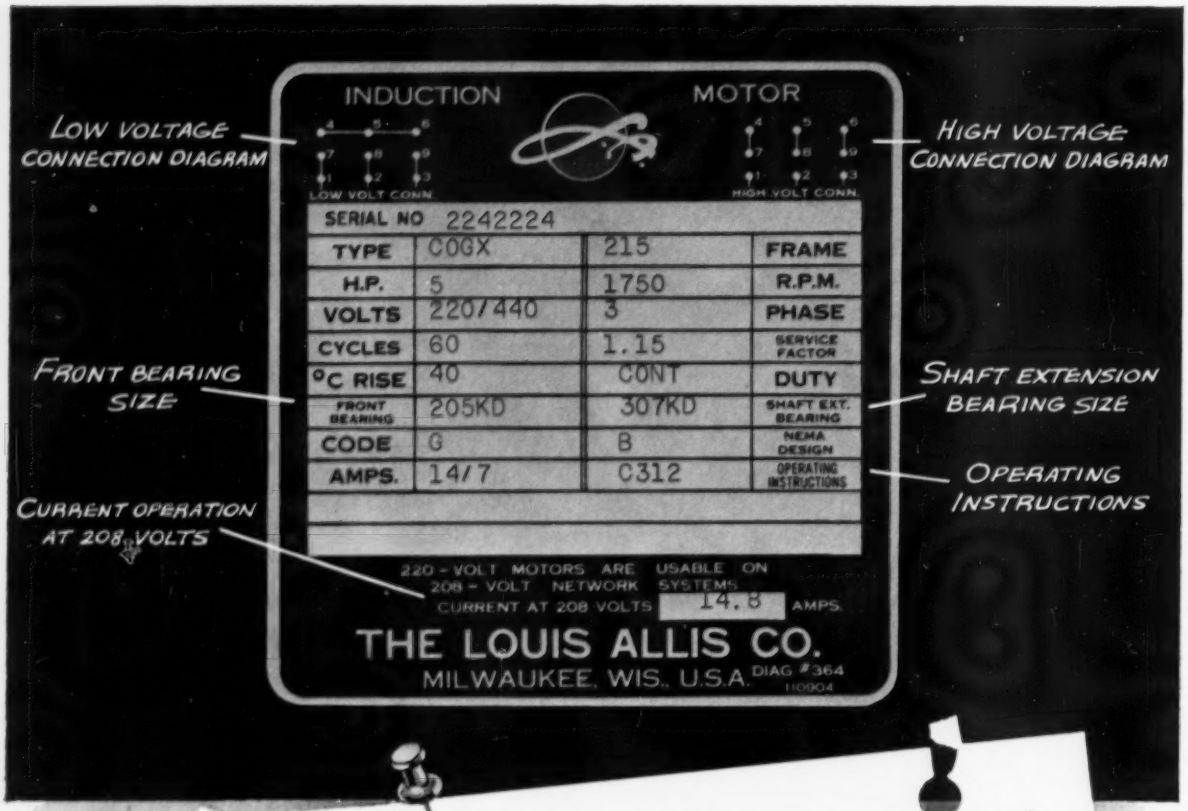
Circle 4A on reply card


LOW VOLTAGE CONNECTION DIAGRAM
HIGH VOLTAGE CONNECTION DIAGRAM
FRONT BEARING SIZE
SHAFT EXTENSION BEARING SIZE
CURRENT OPERATION AT 208 VOLTS
OPERATING INSTRUCTIONS
INDUCTION MOTOR
LOW VOLT CONN.
HIGH VOLT CONN.
SERIAL NO 2242224
TYPE C0GX 215 FRAME
H.P. 5 1750 R.P.M.
VOLTS 220/440 3 PHASE
CYCLES 60 1.15 SERVICE FACTOR
°C RISE 40 CONT DUTY
FRONT BEARING 205KD 307KD SHAFT EXT. BEARING
CODE G B NEMA DESIGN
AMPS. 14/7 C312 OPERATING INSTRUCTIONS
220 - VOLT MOTORS ARE USABLE ON 208 - VOLT NETWORK SYSTEMS
CURRENT AT 208 VOLTS 14.8 AMPS.
THE LOUIS ALLIS CO.
MILWAUKEE, WIS., U.S.A.
DIAG #364
110904

why is this nameplate important to you?

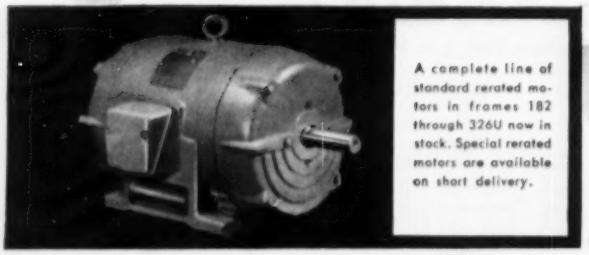
It provides visible evidence that Louis Allis standard motors are built with special care to run better, last longer . . .

Look at the information on this nameplate—information that makes life a lot easier for the user. And to keep this information available at all times, we make this nameplate out of corrosion-resistant stainless steel.

Yes, in the new LA line of standard motors, even the nameplate gets special attention from our engineers. And here's what it means to you:

- The rerated frame size shown means more horsepower from motors with smaller outside dimensions. Performance has been improved by new materials and manufacturing methods.
- Spare bearings can be easily ordered from bearing size and type designations on nameplate, thus eliminating disassembly of motor to determine bearing size. Bearings used are conservatively rated for long life.
- No more lost connection diagram since this information is simply and clearly shown on nameplate. This combined with permanent lead markings, assures that correct motor connections can always be made.
- 220/440 volt motors are suitable for operation on 208 volt systems and full load current for 208 volt operation is included on the nameplate. This eliminates need for original equipment manufacturers to carry a stock of 208 volt motors.

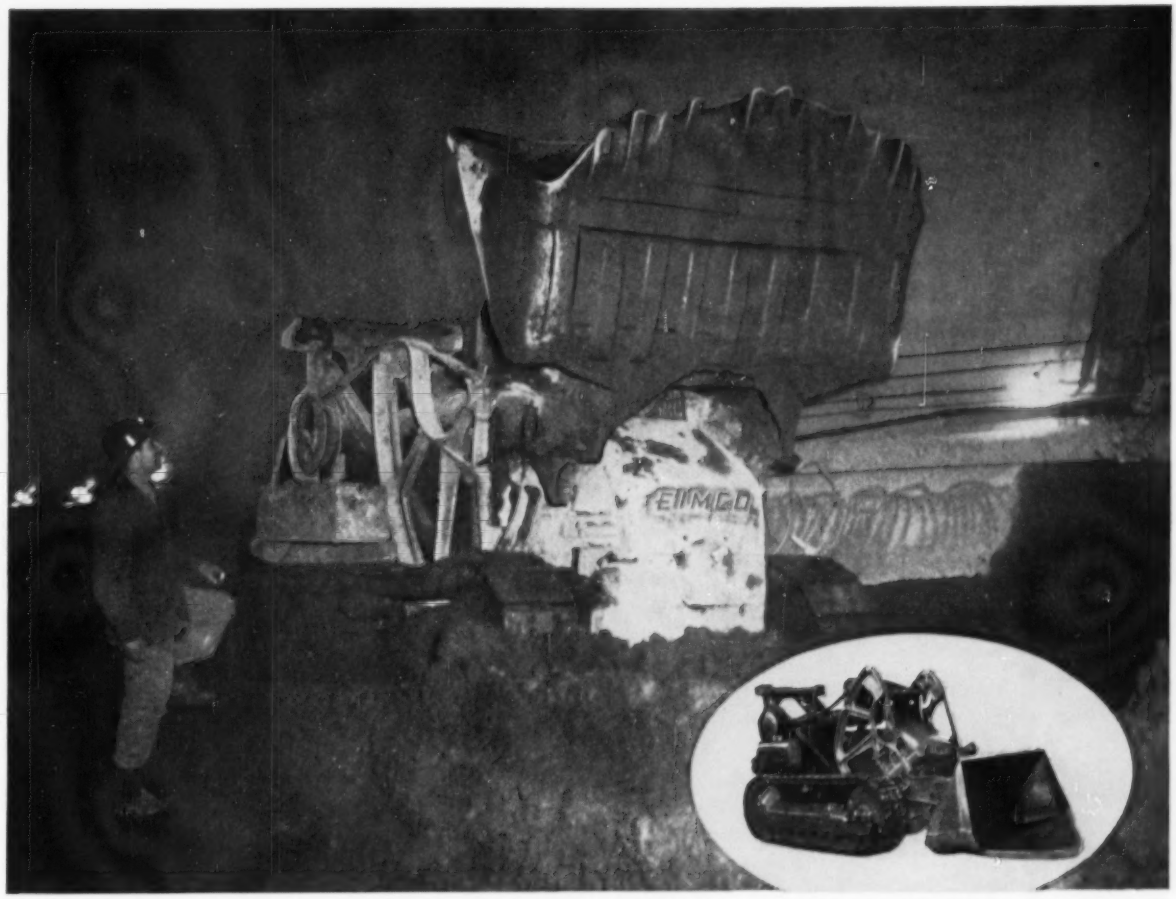
Because they are built with special care, new LA standard motors can do a lot more for you. New bulletin No. 1700 shows you why—just write for your copy.



A complete line of standard rerated motors in frames 182 through 326U now in stock. Special rerated motors are available on short delivery.

LA-106

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN



QUEBEC HYDRO-ELECTRIC COMMISSION USES EIMCO 105 TRACTOR-EXCAVATORS ON BERSIMIS PROJECT

The Quebec Hydro-Electric Commission supplied contractors on the huge Bersimis project with several Eimco 105 Tractor-Excavators as the most efficient machines available for certain phases of the job.

Eimco 105's worked on the penstocks at the powerhouse, loaded blasted rock at the diversion tunnel, mucked in the intake shafts, assisted in clean up of the main tunnel, loaded aggregate from the quarries and accomplished numerous other jobs including, (as shown above) the takeup of the bottom in the main tunnel.

The main tunnel bore at Bersimis is 7 miles long and excavated diameter was 45 feet. The intake shaft on the Diversion tunnel was 32 feet in diameter by 120 feet deep. The Bersimis project is scheduled to generate power by July or August of 1956.

Contractors have worked steadily in the face of adverse weather conditions to complete this great work at an early date. Eimco extends its heartiest congratulations on a job well done.

Eimco 105 Tractor-Excavators are at work throughout the world on Hydro-electric development projects, mines, roadbuilding, stockpile loading, pits and quarries and many other rough jobs. In many instances, the 105 is the only production equipment on the job—because its dependability is a well known and proven fact.

If your project calls for a tractor, bulldozer, or excavator, you'll want Eimco to supply you with full information about the versatile 105. Just send details of your project. You'll find, as have many others, that Eimcos will do the job faster, cheaper and better.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

EIMCO

B-312

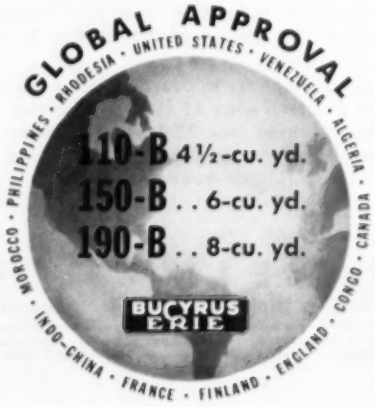
In California...and the World Over Bucyrus-Eries Live Up to Reputation for High Output

Bucyrus-Erie 6-yd. 150-B shovel working at Eagle Mountain mine. Ore bearing formations here are high in iron content and considerably heavier than most rock.

Miners the world over have learned to expect outstanding performance from Bucyrus-Erie Ward Leonard electric shovels — and they get it, no matter how tough the assignment.

The machine above, for instance, is on a California project where it handles massive, heavy iron ore and waste rock — an extremely hard, fine rock which is quite abrasive. It's a true test of an excavator's strength and durability but here, as on other tough jobs the world over, the Bucyrus-Erie shovel moves big yardages economically — day after day, month after month.

It's the *extra margin of quality,* both in design and manufacture, that qualifies Bucyrus-Erie Ward Leonard electric shovels for world-wide acceptance — and lets them live up to it. We would like the opportunity of explaining that extra margin of quality — and what it can mean in performance on your job. 96L56


GLOBAL APPROVAL
MOROCCO • PHILIPPINES • RHODESIA • UNITED STATES • VENEZUELA • ALGERIA • CANADA • INDO-CHINA • FRANCE • FINLAND • ENGLAND • CONGO
110-B 4½-cu. yd.
150-B . . 6-cu. yd.
190-B . . 8-cu. yd.
BUCYRUS ERIE

BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN

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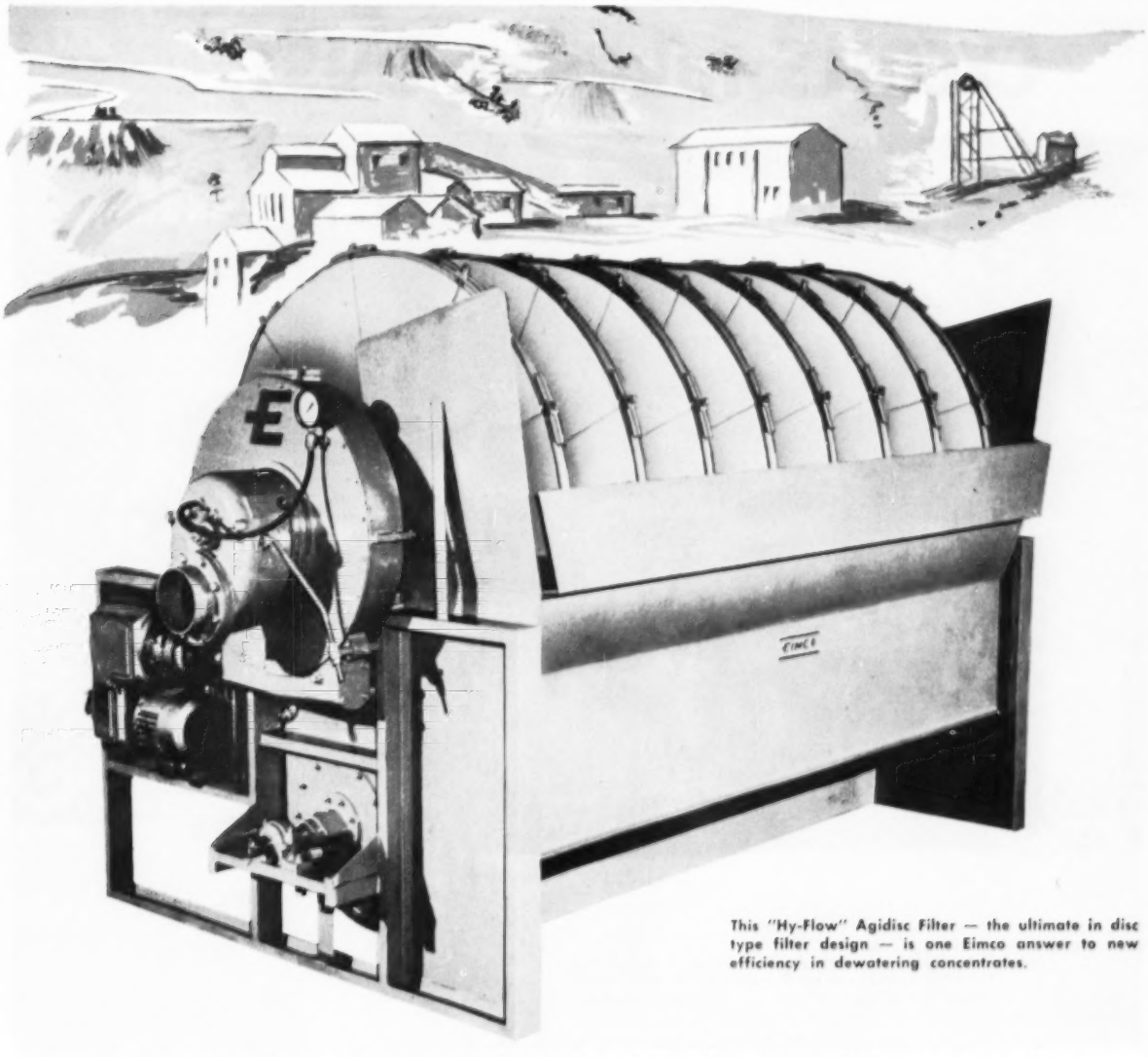


This "Hy-Flow" Agidisc Filter — the ultimate in disc type filter design — is one Eimco answer to new efficiency in dewatering concentrates.

EIMCO "HY-FLOW" AGIDISC NEW DESIGN FOR IMPROVED FILTRATION

Application of the Eimco "Hy-Flow" design to Agidisc filtration is proving to be a practical and money-saving formula for filtering many metallurgical concentrates.

This new design, which enhances operating efficiency in all zones of the filtration cycle, combined with the Agidisc's ability to maintain constant particle suspension, makes the Eimco "Hy-Flow" Agidisc a highly versatile filter.

Enlarged ports, streamlined passages and direct flow allow an unrestricted passage of liquids and gases from the filter media through the valve.

Also eliminated is vacuum loss, since turbulence and right angle resistance bends are no longer present.

The "Hy-Flow" Agidisc incorporates newly designed valves, disc sectors, sector bells and trunnion barrels.

Eimco filtration engineers can produce comparison records to show that "Hy-Flow" Agidisc filtration has dewatered tonnage to a lower moisture content at lower cost than any other filter.

If your operation involves dewatering fast settling solids, the Eimco "Hy-Flow" Agidisc Filter could well be your solution to better filtration resulting in more profit.

Send your particulars to the Eimco Filtration Division. Their advice to you will be based on years of research and experience in the field.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-206

Circle 8A on reply card

CYCOILS take the DUST,

leave only CLEAN AIR

Gulf Oil Corporation, at its Odessa, Texas, Sand Hills Plant, depends on AAF Cycoils to keep tough West Texas dust out of its valuable engines.

THIRTEEN big Ingersoll-Rand gas-engine compressors represent a big investment in fine equipment. They deserve the finest protection. And, when they're at work in oil refining, the stakes become substantially higher.

That's why you see that battery of 22 AAF Cycoils protecting the engine air intakes at the Odessa, Texas, Sand Hills Plant of Gulf Oil.

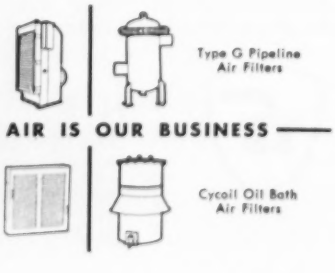
AAF Cycoil heavy-duty oil bath air cleaners provide 4-way cleaning: impingement, scrubbing, cyclonic action and filtering. Over 90% of the fine dust content in the air is trapped in oil and removed by centrifugal action before most of it even reaches the filter pads. Additional filtering pad action provides air that's virtually 100% *dust-free.*

Only Cycoil gives engines and compressors such remarkable protection. Write for Bulletin No. 130. It's the story of Cycoil Oil Bath Air Filter. And it's jam-packed with the kind of facts that save trouble . . . and money.

AAF — American Air Filter COMPANY, INC.

402 Central Avenue, Louisville 8, Kentucky

American Air Filter of Canada, Ltd., Montreal, P. Q.


Type CMS Multi-Duty Filters
Type G Pipeline Air Filters
BETTER AIR IS OUR BUSINESS
Type OCH Intake Air Filters
Cycoil Oil Bath Air Filters

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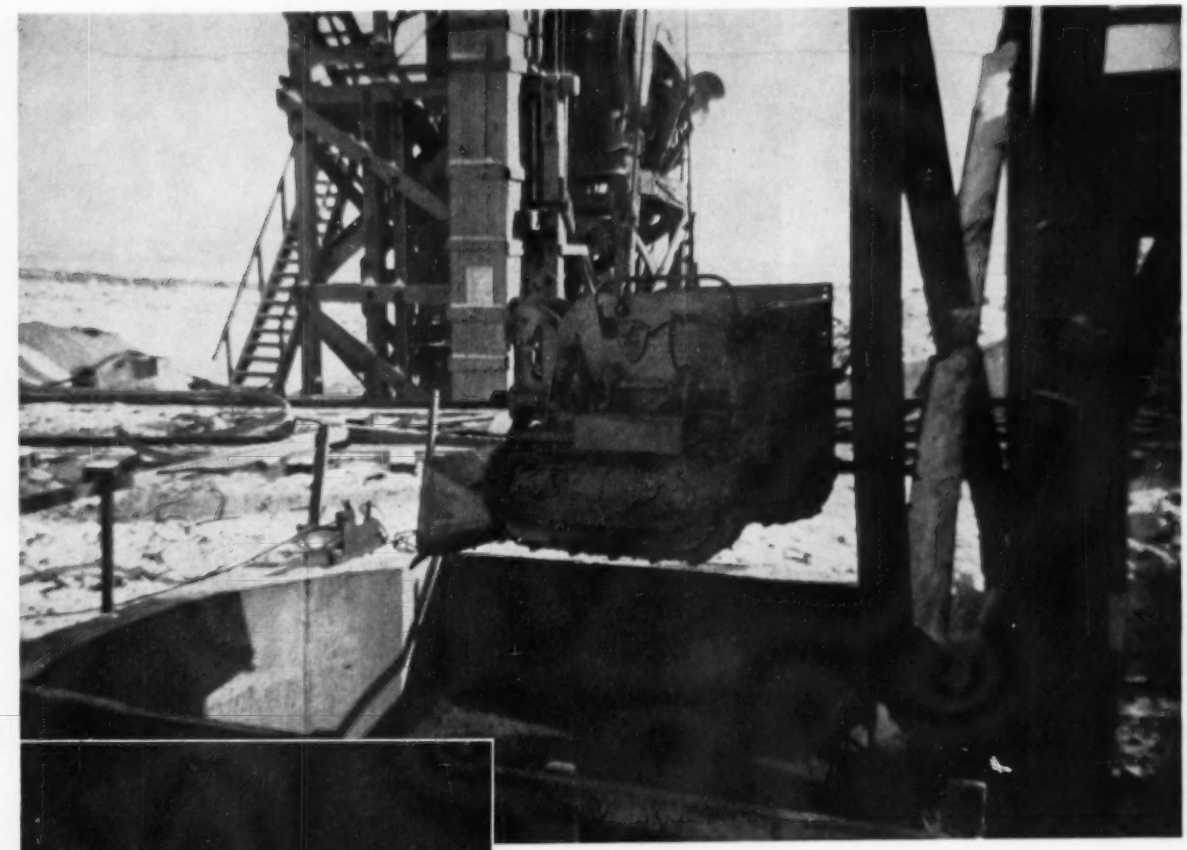

Standard Underground Eimco 630's Sink Shafts Faster — Cheaper.

You can save money and sink shafts faster using standard underground mucking equipment if it's an Eimco 630 Excavator.

On two recent occasions, contractors reported they were happy to leave special purpose shaft mucking equipment on the surface while the standard Eimco 630 did the entire excavating task.

They discovered as have many others that they can accomplish more with a smaller crew and minimum investment when a 630 is on the job.

There's no **special** rigging, **special** guides and **special** platforms to be lowered down the shaft with an Eimco.

Whether the shaft is circular or rectangular, the 630 is loading successfully for contractors.

And when the job is done, the 630 is ready to start excavating drift from the bottom of the shaft.

Eimco 630's are safe, fast and economical.

Write for Bulletin L-1039 today!

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Cleveland, Ohio Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-211

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EXPLOSIVES

RESEARCH

PAYS OFF

There's no substitute for the right combination of explosives materials and the "know-how" for getting results that save both time and money. Hercules has specialized in the pioneering of improved explosives techniques for more than 40 years. We will be glad to assist you in selecting the right materials and blasting methods to meet your particular requirements.

HERCULES POWDER COMPANY
INCORPORATED

Explosives Department, 932 King Street, Wilmington 99, Delaware

Birmingham, Ala.; Chicago, Ill.; Duluth, Minn.; Hazleton, Pa.; Joplin, Mo.; Los Angeles, Calif.; New York, N. Y.; Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Calif.

XR56-5

Not Just CORROSION-RESISTANT

BUT CORROSION-PROOF

Corrosion resistance is not enough to stop acids or alkalies from chewing up a motor in a hurry. That is why the wise engineer selects Reliance Corrosion-Proof Motors for corrosive service.

These motors are built to withstand the onslaught of destructive chemicals for years. Housings are made of virtually indestructible cast iron. Exterior contours are designed to slough off liquids—no nooks and crannies to retain corrosive elements. Enclosures are sealed to prevent any leakage . . . Metermatic lubrication systems provide complete protection against burned out bearings and contaminated lubricants.

Anyway you look at them, Reliance Corrosion-Proof Motors can take it—and you're not limited in the choice of motors either. A complete line of a-c. motors, 1 thru 300 hp., is available in all mountings, frequencies and voltages.

Why not call your Reliance representative today and get all the details.

B-1505

RELIANCE *Totally-Protected* MOTORS

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 78A, CLEVELAND 10, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO

Sales Offices and Distributors in Principal Cities

Circle 11A on reply card

Circle 12A on reply card

and blasting methods to meet your particular requirements.

No clutch to wear, slip or adjust. Operation reversible. Nickel alloy steels provide the toughness, hardness and high strength/weight ratios needed in vital parts of two new Torsion-Bar Torque Control Impactools. One for heavy bolted steel construction . . . shown here . . . has adjustable torque range up to 550 foot pounds. The other, to 90 foot pounds. Produced by Ingersoll-Rand Co., Air and Electric Tool Division, New York 4, N. Y.

Nickel alloy steels toughen new tool to run nuts, full speed, to preset torque

No pressure regulator, yet this revolutionary new Impactool speeds the run-down of nuts to a desired tightness, and then automatically shuts off. You can use it at full power and speed.

Nickel steel stands gaff

Heart of the tool . . . shown in the drawing . . . is the torsion-bar torque control. This vital mechanism uses nickel alloy steels to withstand impact and stresses from blows hammered at a rate reaching up to 2400 per minute.

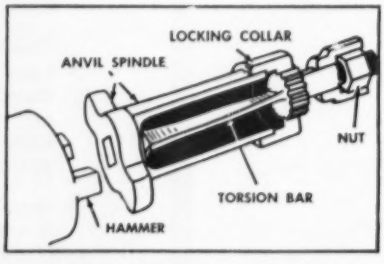
Ingersoll-Rand engineers use nickel steels to obtain hard, wear-resisting, non-spalling surfaces supported by cores with ample toughness to resist shocks and overloads. As in anvil lugs and locking collar.

For torsion bars, the engineers use a grade of nickel alloy steel that combines toughness with high yield strength.

You can improve specific *mechanical* properties in many a metal by adding nickel . . . alone or in combination with other alloy elements. In addition, the nickel content helps to improve *fabricating* properties.

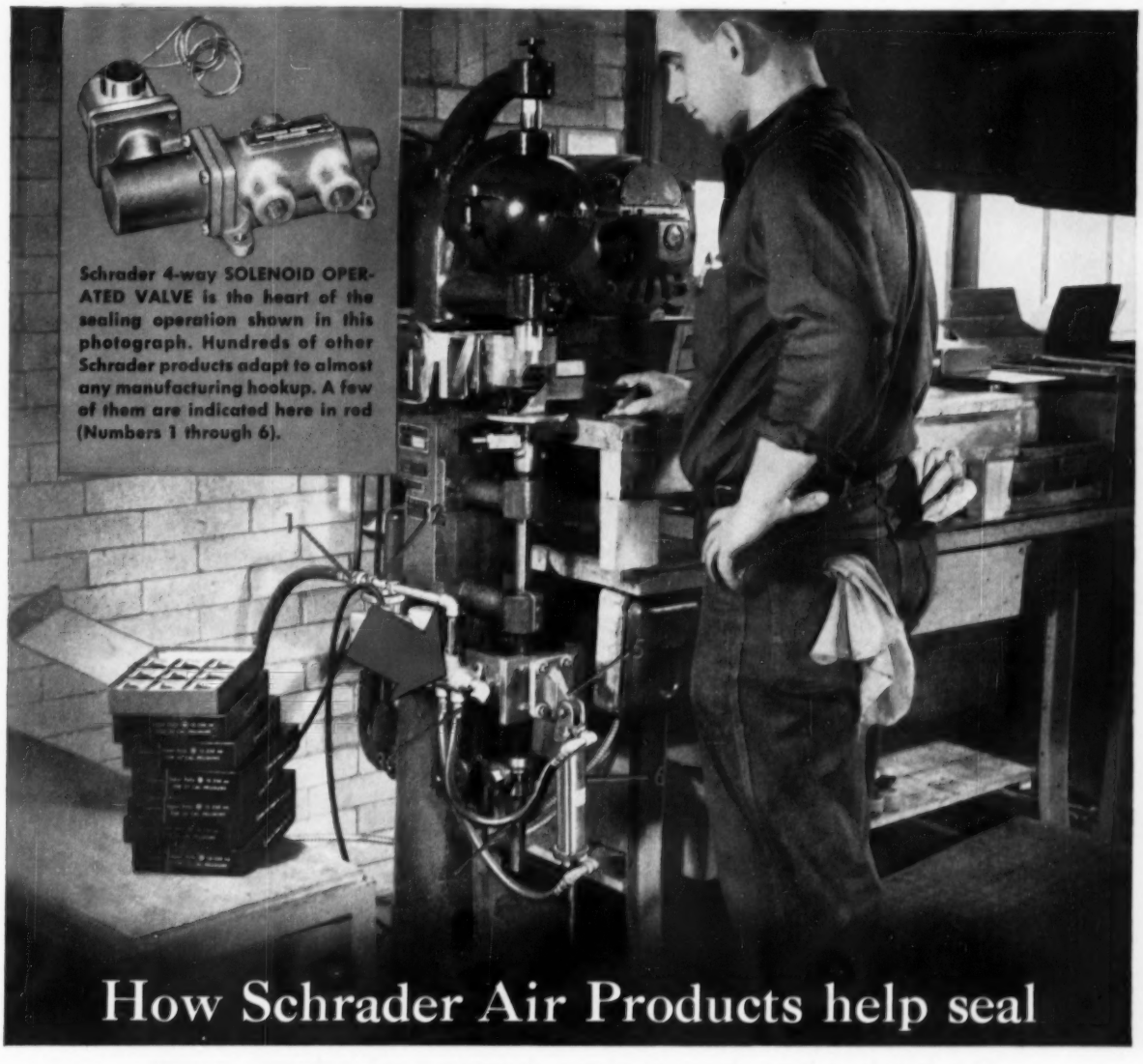
. . .

Whatever your product, when you face questions about metal let us give you the benefit of our wide practical experience. Write for "List A" of available publications. It includes a simple form that makes it easy for you to outline your problem.



Anvil lugs, spindle, torsion bar and locking collar of Impactool torque control mechanism are nickel alloy steels notable for toughness. When nut running resistance equals preset stress, torsion-bar snaps back, causing hammer to rebound and trigger shutoff valve.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.


Schrader 4-way SOLENOID OPERATED VALVE is the heart of the sealing operation shown in this photograph. Hundreds of other Schrader products adapt to almost any manufacturing hookup. A few of them are indicated here in red (Numbers 1 through 6).

How Schrader Air Products help seal

5000 pellet boxes per day–3 times faster!

Box sealing is a common operation performed by compressed air. Just how speedy it can be is demonstrated at a New York arms manufacturing plant, where 5000 boxes of pellets are crimped tight each day. The back-breaking job of crimping by foot power is eliminated, and the operator does not become fatigued.

Wherever operations are automated—in holding or positioning work, moving scraps or chips, or synchronizing actions—air can help. By making these steps automatic, more efficient manufacturing is achieved.

In many cases this can be done more economically with Schrader Air Products than in any other way. Upon request, Schrader engineers will assist you in planning for the most efficient use of air and in selecting the products best suited to your applications. Outline your problem to us . . . we'll be glad to help you. Or, send for the latest informative booklets which show Schrader Air Products that will help you increase production—economically.

Schrader®
ESTABLISHED IN 1844

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
478 Vanderbilt Avenue, Brooklyn 38, N. Y.

FIRST NAME IN THE USE OF AIR
FOR INDUSTRIAL PRODUCTION AND CONTROL

Circle 13A on reply card

A few of the thousands of crankshafts produced at National Forge for new diesel engines.

HAVE YOUR CRANKSHAFTS RECONDITIONED BY A FIRM EXPERIENCED IN MAKING ORIGINAL CRANKSHAFTS

National Forge has been making crankshafts for diesel engines for many years... starting with our own basic electric steel and ending with a shaft ready to install in original equipment, we have a wealth of "know-how" regarding crankshafts.

Recently, National Forge has added a new crankshaft reconditioning division. This includes a large chromium plating department and additional grinding, straightening, and inspection equipment for handling crankshaft reconditioning on a production line basis.

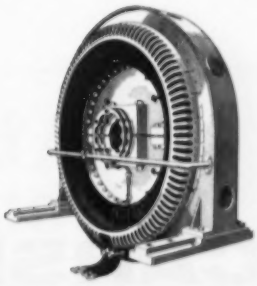
National Forge's large modern facilities and years of experience in producing new crankshafts assure you of proper handling and good workmanship on your reconditioning jobs.

We will be glad to have our field representative call on you to discuss your needs.

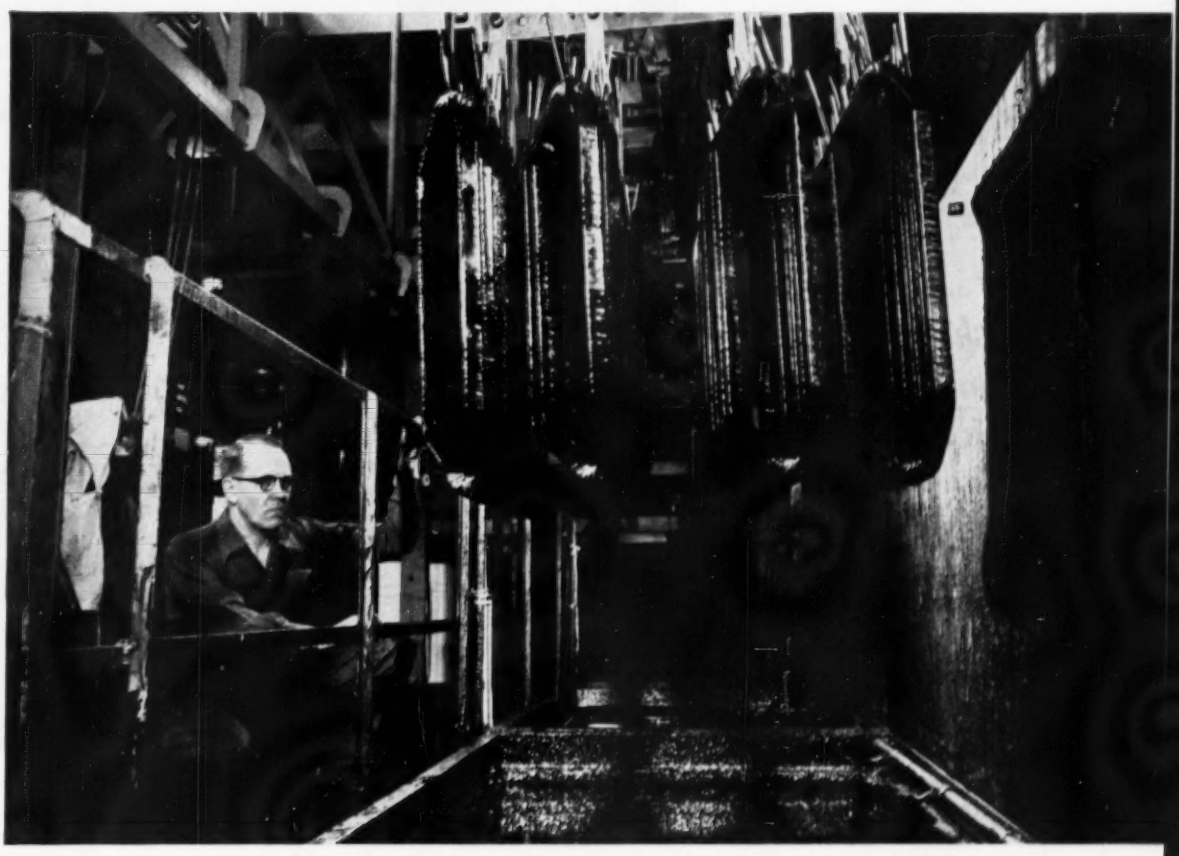
NATIONAL FORGE AND ORDNANCE COMPANY

PRODUCES BETTER STEEL FORGINGS AND MACHINE WORK

IRVINE, WARREN COUNTY, PENNSYLVANIA



HOW G-E SYNCHRONOUS MOTORS
REDUCE MAINTENANCE COSTS



An insulating bath helps fight moisture

Moisture has the unhappy habit of working its way through motor coil insulation and reducing its capacity to withstand voltage stress. To guard against exasperating production-line shutdowns, General Electric seals coils with a coating of high-grade insulating resins. This seal is applied by a conveyor belt dip and bake system.

It works like this. After the main body of insulation is applied in the form of tapes and films of non-hygroscopic materials, each set of coils is placed on a conveyor and dipped in a bath of special, synthetic insulating materials. This way the coating is uniformly applied. Then the conveyor carries the coils into a huge oven and cures them for a specific length of time. The cycle is repeated until the proper seal is built up. Each step is automatically and precisely controlled—length of dipping and baking time and temperature.

This means the coils on your G-E synchronous motor are protected by a hard, tough insulation with high dielectric strength and high resistance to moisture and contaminants. Its glossy surface makes the coils easy to clean too.

All this adds up to less maintenance and down-time. For more information on G-E synchronous motors, contact your nearest General Electric Apparatus Sales Office or write Section 775-4 for Bulletin GEA-5332. General Electric Company, Schenectady 5, N. Y.

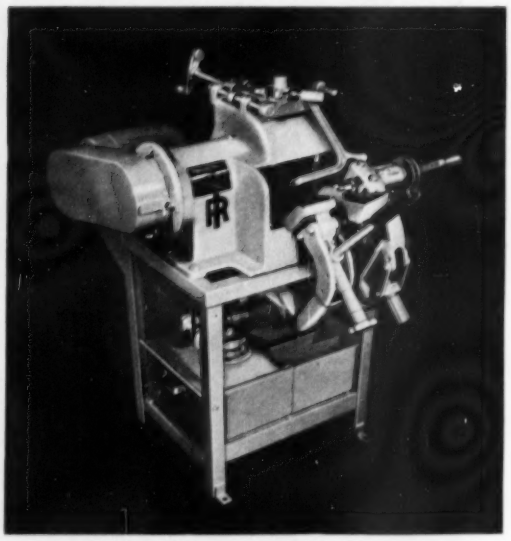
GENERAL ELECTRIC

CARSET JACKBITS

LAST LONGER, DRILL FASTER THAN EVER

...when you keep them sharpened, with machine precision, on the new

JC-3 JACKBIT GRINDER



A NEW Ingersoll-Rand Carset Jackbit has no equal for sustained high drilling speed and maximum bit life in practically any type of rock.

To maintain this "good as new" performance after resharpening, it's important that the cutting faces be ground without unnecessary waste and to the proper shape. Although hand grinding can be used successfully where the number of bits sharpened per day is limited, higher production calls for a *faster* and *more precise* method of resharpening.

These requirements are met to excellent advantage with the new JC-3 Jackbit Grinder. All bit surfaces are ground with machine precision to exactly the right shape for maximum drilling efficiency — more quickly, easily and accurately than can be done by hand grinding.

While the JC Grinder has many new and improved features, it has the same basic design that has proved itself in over 20 years of service. All bearing and wearing surfaces are protected against the entrance of abrasive grits, virtually eliminating bearing maintenance costs. The Jackbit Grinder can be purchased complete with cooling and gauging equipment and electric, air-motor or gasoline-engine drive — or it can be obtained with only that equipment needed for any particular job. To get the *most* out of your Carset Jackbits, ask your I-R representative for complete information on this time-saving, cost-saving Jackbit Grinder.

15-416

FREE WALL CHART: HOW TO GRIND CARSET JACKBITS

Ingersoll-Rand, Rock Drill Dept., 11 Broadway, New York 4

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ON THE COVER

A TRACT of land at the base of the Hawaiian volcano Mauna Loa has been cleared of a dense jungle growth by Castle & Cooke, Ltd., and is now yielding macadamia nuts. The first small harvest was gathered last year, and the annual crop is expected to reach five million pounds by 1970.

Since 1949 more than 70,000 trees have been planted. Most of them were set in holes bored with augers, but occasionally, when subsurface rock was encountered, a rock drill was brought into play to make a hole for a stick of dynamite.

Now that the trees are beginning to bear, the growers are experimenting with equipment to facilitate gathering the nuts after they have fallen or been shaken to the ground. Our cover picture shows a gasoline engine-driven vacuum picker that is manufactured by Circle V Nut Harvesting Company of Fort Worth, Tex. It is widely used for harvesting pecans and other kinds of nuts in the United States.

IN THIS ISSUE

LARGE corporations understandably locate their principal offices in big cities where the pace is fast. Research, however, is a deliberate, slow-moving activity and thrives best in a bucolic setting where there is less interference with meditation and painstaking experimentation. In the quiet Hudson River Valley community of Beacon, N.Y., 1100 people staff the main research facilities of The Texas Company, one of the largest producers, processors and marketers of petroleum and its products. Some of the things they do there are told in our leading article.

•

THE colonial ironworks at Saugus, Mass., stayed in business for only about 20 years, but it was the first integrated undertaking of its kind on these shores and was the training ground for men who later ran similar establishments in other states. For these reasons its restoration, carried out with scrupulous regard for authenticity, is important. Open only a year, it has already become a popular tourist stopping point. Page 232.

•

AIR-POWERED clamps are being increasingly applied to industrial holding jobs because they are simple, powerful and convenient. A Finnish engineering firm utilizes some large ones to hold ship's plates in place while they are being welded. Hans Branders, general manager of the works concerned, describes some of the manufacturing methods. Page 236.

Compressed Air Magazine

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Investment for Future

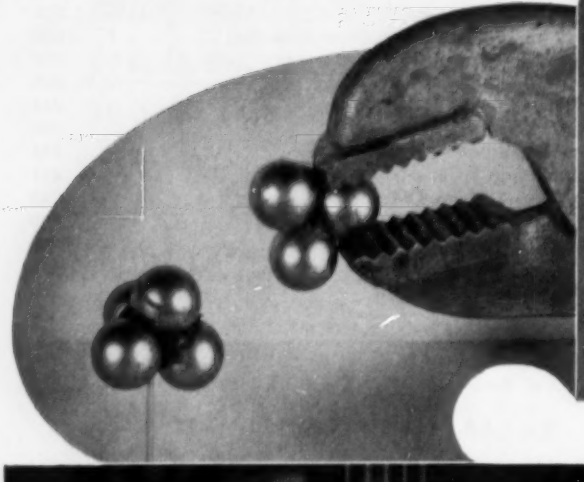
Texaco Research Laboratories

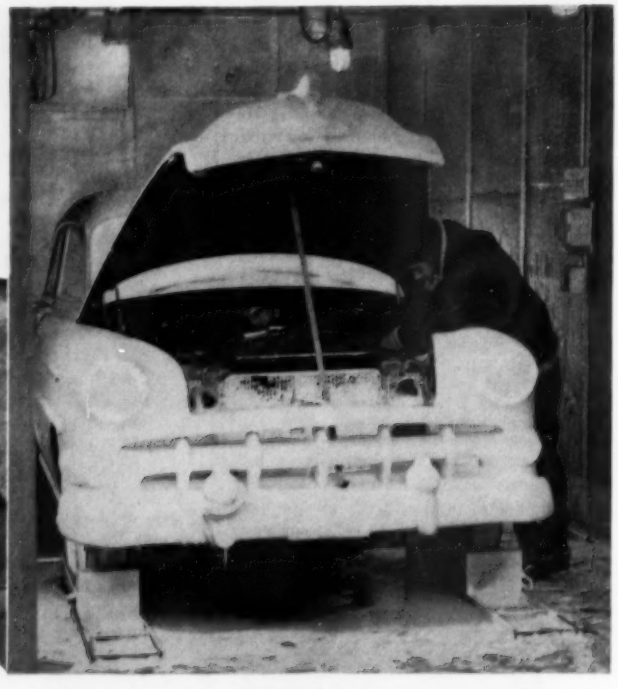
Scientific Investigations, Centered at Beacon, N. Y., Help The Texas Company Maintain a Fine Reputation

R. J. NEMMERS

WHEN LUBRICATION FAILS

What happens when there is metal-to-metal friction without lubrication is illustrated below. To test lubricants, four bearing balls are clamped touching each other — three in a fixture and a fourth in a mandrel. Lubricant is applied, and the fourth ball is rotated at high speed. The effectiveness of the grease is measured by the time it takes to break down and for seizure to occur. As shown, the heat of friction after the lubricant fails is so great that the metal in the balls begins to flow and welds them together. The band around the uppermost ball in the cluster at the left was caused by the mandrel clamp slipping when seizure occurred.





OPERATION DEEP FREEZE

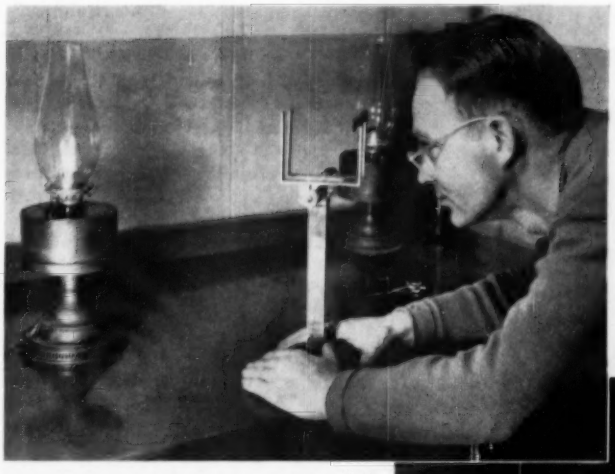
Unless you live in one of the extreme cold zones, your car probably will never get this frosty, but Texaco products enable vehicles to operate under such severe conditions because they are first checked in the Beacon cold-temperature laboratory. Keanon Kirby in an exposure suit is shown engaged in making such a study.

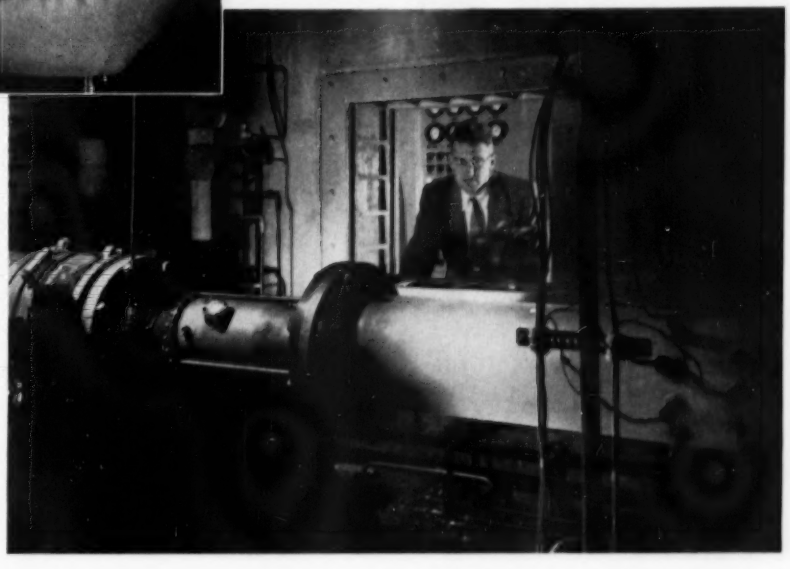
DO-IT-YOURSELF EXPERT

Much of the equipment needed for special tests can't be bought and must be built by the laboratories' personnel. Whenever possible, glassware is purchased, yet five glass blowers are kept busy. One of them, Leland Phillips, is shown at a glass-blowing lathe sealing a distillation head with an expansion bellows to a molecular still.

INDUSTRIAL research has come to play a decisive role in our economy. Many leaders of industry believe it to be the last great frontier open for the growth of the United States as well as for much of the rest of the world. The impetus it gives to our economy in terms of gross national product is out of all proportion to its small cost. Approximately $4,000,000,000, about 1 percent of our expected GNP for this year, is slated for laboratory work. Yet it is estimated that more than 20 percent of the gross product will be derived from goods not known a decade ago and developed since then largely because of knowledge gained through research.

Programs of continuing research as answers to specific industrial problems





FUEL OF THE PAST — AND FUTURE

Large quantities of kerosene are still used for lighting, heating and cooking, and Beacon scientists check its burning qualities in lamps. Paul Howe is shown at the left taking a reading of flame measurements through a sight gauge. In contrast, Charles M. Kuhbach, engineer-in-charge of the new jets-fuels laboratory, observes a test run (below) of the combustor section of a Rolls-Royce Dart aircraft gas turbine. The glowing exhaust pipe (center) indicates the intense heat generated by the burning fuel in the jet combustor (the component with the small, round quartz window just left of the exhaust section). The burner is held between two heavy flanges, the one at the input end of the combustor (left) having several expansion sections. Wires and connections (right) are for thermocouples which measure the heat of the exhaust gases. (Exhaust temperature provides an index of the efficiency of combustion.) The glowing area is often insulated to prevent heat loss between the burner and the thermocouples.

have been undertaken only in the last 30 years. Acknowledgment of such expenditures by corporate officers as necessary to the expansion of a company has been matched by the average man's growing faith in science. Some of our readers can probably recall when most people were afraid, or at least suspicious, of electric lights and when horseless carriages were ridiculed publicly. Contrast that attitude with the ready acceptance of the new and different in this day and age. In fact, so great is our trust in science that if travel to the moon became possible today one institute could furnish a list of more than 25,000 Americans who have indicated their willingness to make the journey.

Most of us have preconceived notions about research laboratories. Generally, we think of them as the movies portray them—as secluded "ivory-towered" places where doctors of this, that and the other move about slowly practicing a strange alchemy. True, many of the academically trained people found in them have the Ph.D. degree that is the hallmark of the research profession, but little of a weird nature goes on behind the scenes. Nearly all the work carried on there is intimately related to all of us.

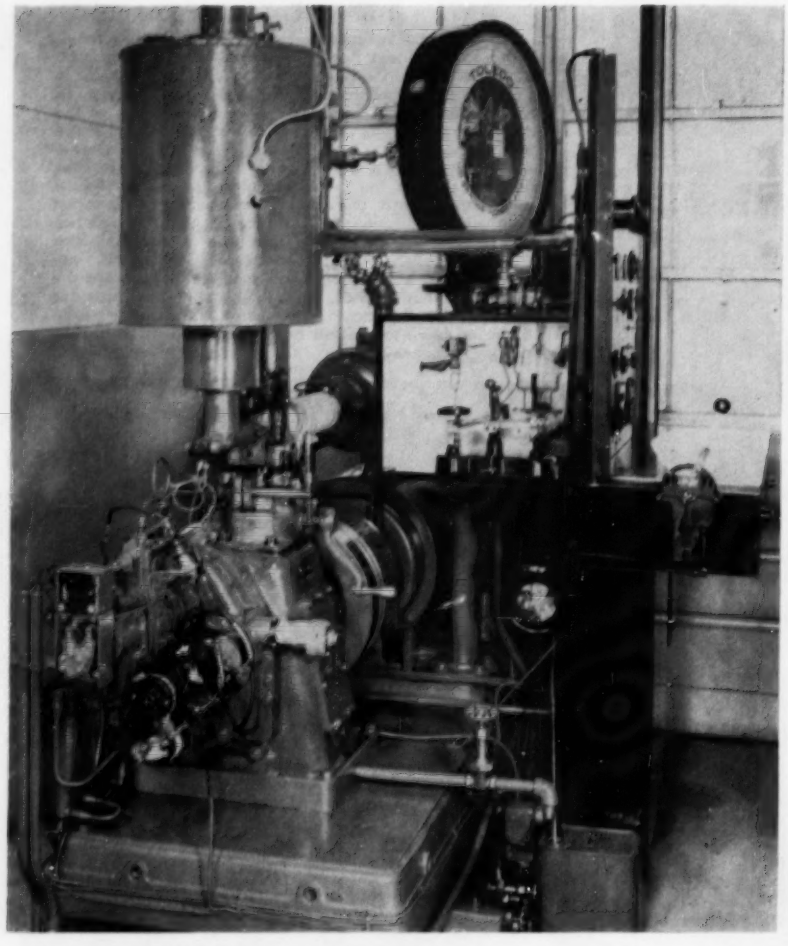
To give a comprehensive picture of the present-day extent of research we will describe one of the laboratories of The Texas Company, one of the world's largest fully integrated oil-producing and marketing firms with a net income for 1955 of $262,729,738. Its products are merchandized everywhere. In the Western Hemisphere and West Africa they are identified by the well-known Texaco trademark and brand names. In other nations of the free world they are handled by affiliates such as Caltex, which uses its own trademarks but retains Texaco's brand names.

The company long has been a leader in industrial lubrication as well as in sales of gasoline and oil to consumer markets. Much of the credit for establishing and maintaining its position in these highly competitive fields is attributable to the active and aggressive sales force built up over the years. But no sales staff can hope to continue marketing a product that is not as good as or not equal in value to that of a competitor. It is therefore supplemented by the Research and Technical Department which helps the company to hold its position not only by keeping its products more than adequate for their varied uses but by providing new lubricants and fuels to meet changing markets, by developing refining processes for the manufacture of its products and by solving knotty customer problems.

Texaco has five research centers. The largest, with which we are primarily concerned, is at Beacon, N. Y., and is the headquarters of its Research and Technical Department. Others are at Port Arthur, Port Neches, and Bellaire, Tex., and at Montebello, Calif. Perhaps the only thing about the Beacon research center that fits the stereotyped concept of such a place is that it is rather secluded. The reason for this is that the company's management wants it to be separated physically from all production sections so that the personnel's technical skills cannot be usurped to solve day-to-day operating problems. Hence, the engineers and scientists are free to concentrate on their assigned tasks.

Beacon is a pleasant community of approximately 15,000 people located on the Hudson River about two hours by train or car from New York's hustle and bustle. The research and administration buildings are just outside the city limits on a 187-acre tract traversed by Fishkill Creek and occupy 346,542 square feet of floor space within a 25-acre fenced-in area. The extent of the facilities can be more fully comprehended when it is known that the center is made up of 91 chemical laboratories and 66 engine test stands and employs about 1100 people. Of the latter, some 290 are scientists and 200 are trained technicians. Craftsmen and specialists, who are needed to carry on the day-to-day activities and to keep the labs in good working order, clerks, stenographers, laborers and janitors represent the remainder.

Founded in 1931, the Beacon laboratories are composed of three primary divisions: research, technical services and



OCTANE DETERMINATION

The ASTM supercharged aviation test engine in the front provides information about octane ratings of fuels burned in supercharged engines. Compressed air of carefully regulated temperature, pressure and volume serves as combustion air in the single-cylinder unit. The scale dial visible in the background is part of the loading and dynamometer equipment which measures the power output of the engine and thus of the fuel under test.

operations. The first-named conducts basic research and consists of eight departments: analytical, chemicals, fuels, project evaluation, engineering, physical, greases and lubricants. It strives to come up with new products and new or more efficient processes for making them; develops data on the behavior of fuels, lubricants and other oil products; and provides work for approximately one-third of the labs' employes.

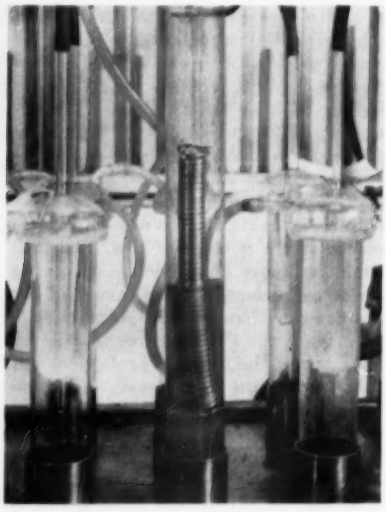
The Technical Services Division is the information bureau for the laboratories as well as for all other company departments. It also carries out chemical, physical and mechanical tests for the Research Division and assists manufacturers and customers in the selection of products best suited for their particular requirements. One of the important functions of this group is that conducted by its Standardization Department which examines, calibrates and certifies all apparatus in Texaco's research centers as well as in each of its product-control laboratories. In addition, it is responsible for establishing standard test procedures (within the limits of industry standards) so that results will be uniform no matter where, when or by whom the investigations are made. This is of vital importance in order to insure products that will always perform exactly the same way each time they are used.

The Technical Services Division also acts as a scouting group. It is the duty of the field representatives to work closely with manufacturers in designing new machines and to report new applications to the Research Division so that lubricants and fuels will be available when they are needed. In later stages of development the group makes specific lubrication recommendations, and after a product has been placed on the market it is again called upon to coöperate with the purchasers of the equipment.

The Operations Division runs the auxiliaries, maintains the labs and provides craftsmen and clerical help to support the activities of the other two divisions. It is made up of electronics, engineering-design, report-abstracting, reproduction, computing-machine, medical, photographic, glass-blowing, electrical, metal-machining and carpentry groups. Besides, it is in charge of the laboratories' 25,000-volume technical library.

Obviously, precision is essential in research, and the specialists in the Operations Division have often demonstrated their ability to work to extremely fine tolerances. As an example of what can be done when necessary, one of them made a small drill bit—a bit so tiny that the tip could not be seen with the naked eye. With it he drilled a hole through a human hair and then threaded a rabbit hair through the hole. It should be pointed out that the hair was not split in the process.

The Beacon laboratories are devoted to the study of fuels and lubricants for all industries, and among their facilities are machines that represent a considerable investment and that serve solely to determine the best way to lubricate them and the proper lubricant and/or



TURBINE-OIL TEST

To help determine how long an oxidation-inhibited turbine oil retains its protecting qualities, oxygen is bubbled through the oil in the presence of water and a catalyst. One of the reaction tubes is shown (center) partly withdrawn from a bath which keeps it at a temperature at 95°C (203°F). The coil is the catalyst and is made of iron and copper wire. Because of the high temperature, water-cooled condensers are inserted in all the test cells to prevent a reduction in the volume of the sample. The water connections to those at the sides are visible. The vertical glass tubing entering each cell carries oxygen to a porous-stone bubble head near the bottom.

fuel for them. Other equipment is used not only for test purposes but also to provide power or to do other jobs. Among the latter is a small hydroelectric plant that feeds kilowatts into laboratory delivery lines when Fishkill Creek is running high enough to turn the turbine. There are compressors to supply air for laboratory needs and, to a small extent, to test the company's line of compressor lubricants. Also available are special compressor installations—a unit with an hourly capacity of approximately 5 liters (5.28 quarts) of liquid air, oxygen or nitrogen to meet the requirements of the low-temperature research group and a machine that furnishes large quantities of air to a gas-turbine test stand.

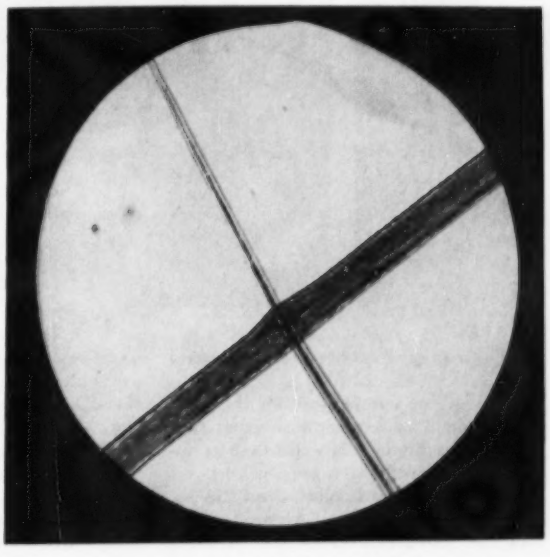
One phase of the work at Beacon that is of interest to most of us is that which deals with fuels and lubricants for motor cars. Every year one or more of each popular make of automobile is given a complete test on a chassis dynamometer where it is subjected to speeds as high as 80 miles an hour, gradients of any desired degree and varying loads. Changes in design affecting operating conditions are carefully investigated to determine what effect, if any, they will have on the behavior of Texaco products. In addition, the automotive check group supervises extensive studies to determine how they perform in commercial fleets. In 2½ years, to mid-1956, the company has conducted 3,604,000 miles of road tests. Fluids for automatic transmissions also are evaluated and their reaction to low temperatures is examined.

It is an easy step from the subject of internal-combustion engines of the Otto type to Diesel, Hesselman and other special engines and to 2- rather than 4-cycle power plants. The use of fuels and lubes for outboard motors is carefully investigated, as well as product behavior in big marine and railway diesels, two full-size engines of the latter type being maintained in the labs. Special fuels such as liquefied petroleum gas are examined, and a number of engine test stands are set up on a more or less permanent basis to check octane and cetane ratings, etc.

As a knowledge of performance ratings of supercharged engines is of great importance in this aviation age we will devote some space to a description of the apparatus and methods utilized in conducting one of them. Also, it may interest some of our readers to learn just what measures are taken to eliminate as many uncontrolled variables as possible in a test of this kind. Conditions for the study are established by the American Society for Testing Materials, which defines the purpose of the examination as follows: "...a method for determining the knock-limited power (supercharge octane rating) under supercharge rich-mixture conditions of fuels for use in spark ignition aircraft engines."

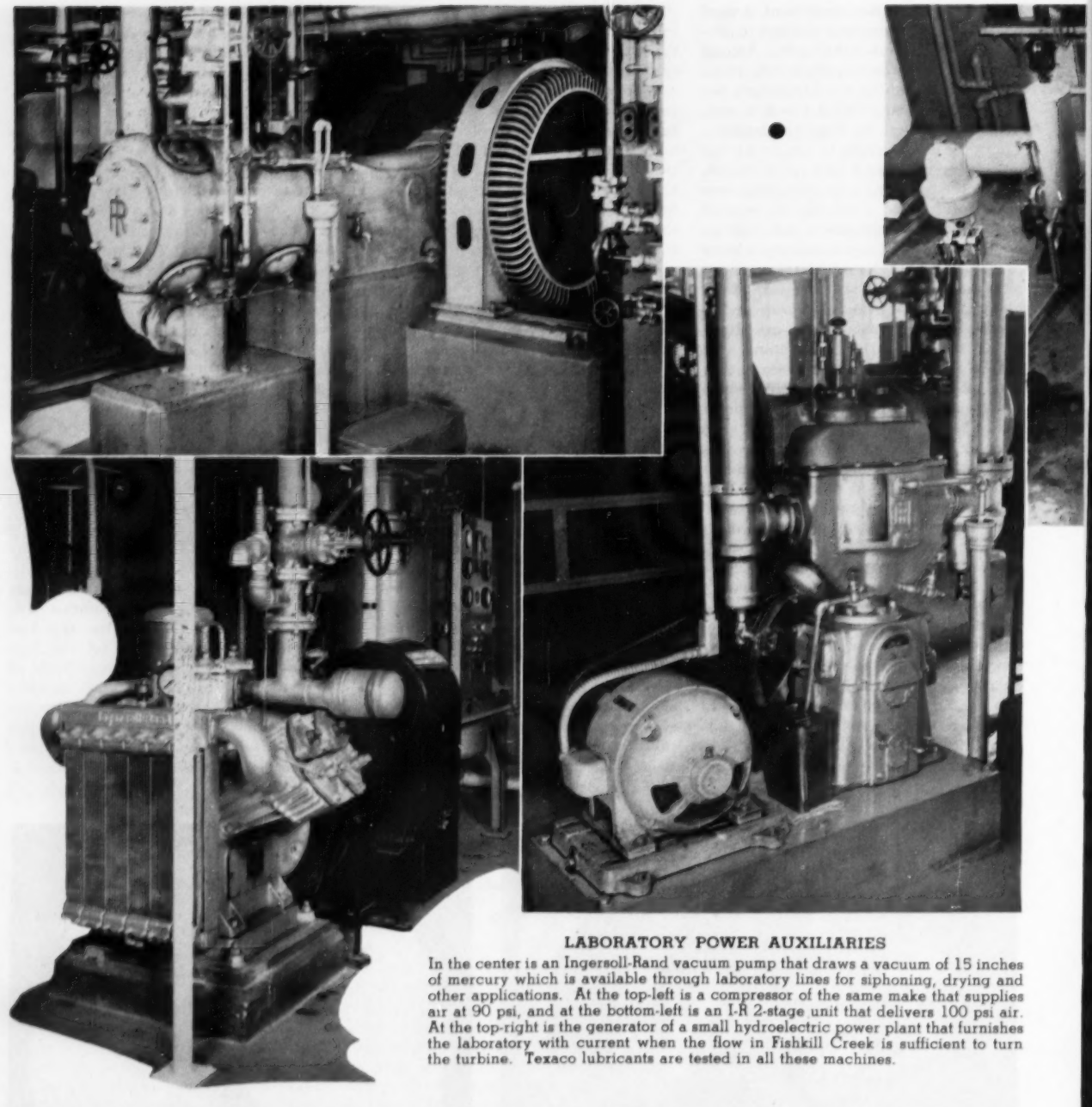
The facilities required consist of a single-cylinder engine that is especially equipped with means to vary the compression ratio for operation at a continuously variable manifold pressure and fuel-air ratio and of suitable loading (dynamometer) and accessory equipment. During the test the engine speed must be maintained at 1800 rpm plus or minus 45 rpm, provided, however, that the maximum speed fluctuation is not more than 45 rpm. The compression ratio is fixed within similarly strict limits, as are the spark advance, spark-plug gap, breaker-point gap and valve clearances. The SAE number and viscosity of the crankcase lubricant, the oil temperature and pressure, the temperature of the coolant, the fuel-pump pressure and the fuel-injector-opening pressure are specified (even the location of the points at which temperature readings are to be taken are indicated). In addition, fuel-injector timing has to be carefully regulated, as well as the pressure of the supercharged combustion air, its temperature at two different places and its humidity.

Compressed air, that is, combustion air, for the supercharged engine is furnished at the Texaco research labs at a nominal pressure of 100 psi and is then reduced to 54.4 (plus or minus 0.5) psi, absolute, measured at the upstream flange of an air-flow meter. From that point on the air pressure becomes a controlled variable. During the test the engine is alternately run on the fuel being studied and on reference fuels of known octane ratings. In each case the fuel-air ratio and manifold pressure are adjusted until the engine develops what is known as "standard knock"—fuel detonation of a standard sound intensity.



LABORATORY LEGERDEMAIN

The ability to drill a hole through a human hair is not an everyday requirement at Texaco's laboratories. But when such precision is needed, it is available. The enlargement above (100 times actual size) proves it. Frank Sassi, the mechanical technician, not only made the tiny drill bit and performed the operation but also contributed the hair.



LABORATORY POWER AUXILIARIES

In the center is an Ingersoll-Rand vacuum pump that draws a vacuum of 15 inches of mercury which is available through laboratory lines for siphoning, drying and other applications. At the top-left is a compressor of the same make that supplies air at 90 psi, and at the bottom-left is an I-R 2-stage unit that delivers 100 psi air. At the top-right is the generator of a small hydroelectric power plant that furnishes the laboratory with current when the flow in Fishkill Creek is sufficient to turn the turbine. Texaco lubricants are tested in all these machines.

Next a reading is taken from the dynamometer. This torque, plus an additional value to compensate for the energy expended to overcome internal friction in the engine, is expressed as indicated mean effective pressure.

The imep value is plotted on the abscissa (vertical scale) of a graph which has the fuel-air ratio as the ordinate (horizontal element). Additional imep values (enough clearly to indicate the maximum or peak power output and also the slope of the rising portion of the curve thus developed) are determined for several different arbitrary settings of the fuel-air ratio, and these points are likewise plotted on the graph, as are values obtained for the reference fuels. The latter are chosen so that they closely bracket the test fuel: one with a power curve slightly above that of the unknown and the other below it. Then the performance number of the test fuel is arrived at by extrapolation from the known ASTM supercharge octane ratings of the reference fuels.

Tests much like the one just described are routine at the research and development laboratories, and in each case the same care is taken to eliminate uncontrolled variables. Even in this modern age scientists check the burning qualities of kerosene in lamps because, according to authorities, large quantities of that fuel are still used for lighting as well as cooking and heating. They also conduct a variety of other product examinations that usually have to do with physical characteristics such as viscosity, pour point, etc., and with chemical properties such as resistance to oxidation, corrosion-inhibiting qualities etc. Flash points, cracking temperatures and the like also are determined.

The test to establish the life of an oxidation inhibitor in fortified turbine oils is an interesting one because of the

use made of compressed oxygen. It is set up so that the oil sample is subjected to a temperature of 95°C (203°F) in the presence of water, oxygen and an iron-copper catalyst. The oil is floated on the water and the oxygen is bubbled through the mixture by introducing it through a delivery head of porous stone. The catalyst is made of lengths of wire coiled to fit around the oxygen delivery tube.

To offset excess evaporation due to the sample's high temperature, a water-cooled condenser is fitted into the neck of the oxidation cell and causes the condensate to drip back into the mixture. Samples are taken each day and tested for acidity—the length of time necessary for the oil to reach a given end point of acid strength or pH value being the measure of the oxidation-inhibitor's life. Even though conditions leading to the breakdown of an inhibitor are greatly exaggerated for test purposes, it often takes several weeks to complete a single analysis.

Another test involves compressors and determines the amount of carbon residue left through the evaporation of oils. (The Ramsbottom coking method recommended by ASTM is described.) A measured sample is injected by means of a hypodermic syringe through a capillary opening into a carefully dehydrated and weighed bulb which, with its contents, is reweighed; fired in a special furnace at a temperature of 1020°F for twenty minutes; cooled in a dessicator and weighed again. The percentage of carbon residue is important to compressor users because excess accumulations leave heavy carbon deposits on cylinder walls and valves and cause leaky valves, overheating of cylinders and generally inefficient compressor operation. Still other tests make sure that compressor oils meet other important requirements and that lubricants intended for rock drills and pneumatic tools are suitable for the purpose.

Studying used products is a big part of the work at Beacon. More than 12,000 samples of spent lubricants are received at the lab each year from Texaco customers for analysis. As a result of the tests it may recommend altering operating conditions, increasing or decreasing the frequency of oil changes and even a different kind of lubricant. Most of the time ordinary practices are resorted to, but once in a while only a very small quantity of oil is available. Then the technicians must depend on microanalysis. From the layman's viewpoint, microdeterminations are fascinating because scientists are able to glean almost any desired information from a minute sample. The scientist, however, though microanalysis is an extremely useful tool, would prefer to have enough material at his disposal so that ordinary methods could be used not so much because they involve less work but because the results can be depended upon to be more accurate.

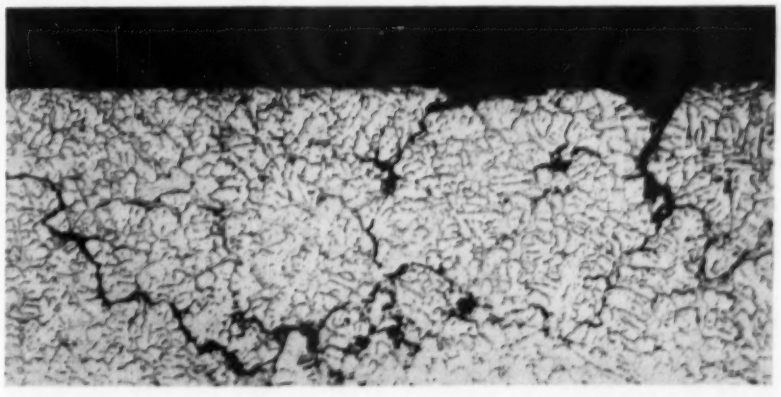
Ofttimes, Texaco field engineers and some customers send in for analysis pieces of bearings that have failed, sections of broken piston rings and entire parts of engines as well as of other machines. The scientists turn to various metallurgical tests to determine the cause of failure, and generally can establish whether the lubricant, operating practices, human error or something else was responsible for the breakdown. Occasionally they are able to show that none of these was at fault, but that the piece was defective from the time of manufacture.

At a research center of the magnitude of that at Beacon, the commonplace and the complex are intermingled to a degree seldom seen in other places. Devices with formidable names such as Electronic Logarithmic Integrator (used to measure electronically the results obtained from an infrared spectrographic determination) and High-pressure Hycosynthesis Reactor (used for the production of synthetic fuels from natural gas) work right along with a simple household kitchen mixer. The former, incidentally, were designed and built by the scientists at the Texaco laboratories, which illustrates still another point.

Because many of the tests are of a special nature—were planned by the research personnel to solve particular problems—much of the equipment must be constructed at the center because it is not available elsewhere. For example, although as much as possible of the glassware used is purchased from supply houses, five glass blowers are kept busy making items that cannot be obtained from outside sources.

The Texas Company's laboratories at Beacon share with industrial labs generally in the search for better products. They are more extensive and delve into more fields than most others, but they were founded simply to promote their own firm's interests by making available to its customers as much information as possible, by assuring them maximum service, and by developing new products that will benefit them.

The place of industrial research in the over-all management plan for the future of The Texas Company was set forth by Mr. Augustus C. Long, president, at the 1955 stockholders' meeting when he said: "Research is occupying an increasingly important place in the everyday conduct of our business as well as in our long-range planning. It is the key not only to improved products and processes but also to increased efficiency and reduced costs."



EVIDENCE OF FAILURE

A knowledge of metallurgy is important to the functioning of the laboratories because the cause of failure of metal parts must be learned prior to forming conclusions about the effectiveness of the lubricant used. This microphotograph shows a copper-lead bearing that failed because it was overloaded.

PART OF RESTORATION

Steelmen are impressed by the fact that this early ironworks was completely integrated. Shown above are the forge (left) and the rolling and slitting mill. Here the pig iron made in the blast furnace was converted into materials that could be used by blacksmiths and farmers.

Cradle of Steel Industry Restored

300-year Old Hammersmith Iron Works at Saugus, Mass., Now Open to the Public

FRANCES GREEN

PHOTOS, AMERICAN IRON & STEEL INSTITUTE

1650-STYLE FORGING HAMMER

The hammer head weighs 500 pounds and has an oak helve. It is raised by cams on a shaft turned by water power and depressed by gravity and the reaction of a wooden spring that is struck at the height of the rise.

AIR under pressure performs many services in modern industry, but rarely, if ever, is it supplied by water power, as was the case 300 years ago at Saugus, Mass. Today, at the country's first successful ironworks which has recently been restored there, a constant forced draft for the blast furnace is provided by two huge leather bellows operated alternately by a heavy wooden shaft which is rotated by a large water wheel. In the forge shop, other wheels power smaller bellows at the hearths where pig iron was once converted into wrought iron bars or rods.

These water-powered bellows are part of the newly reconstructed ironworks which stood on the Saugus site three centuries ago. Then crude iron was produced from bog ore dug close by, charcoal was supplied from surrounding virgin forests and rocky flux from nearby Nahant. Bogs and forests have long since vanished from this area on the outskirts of Boston, but restoration has been carried out as faithfully as possible to show just how that wilderness plant looked and worked at a time when iron was so scarce that wooden pegs often had to be used instead of spikes. Each detail is technically correct and in operating condition, the result of careful research and skilled craftsmanship.

In addition to the blast furnace and forge shop mentioned, the ironworks includes a rolling and slitting mill which was one of less than a dozen in the world when it was built. There bars could be rolled into rods with a simplicity of operation fascinating to those familiar with modern high-speed mills where rods roll out of multistand assemblies with almost unbelievable speed. A few feet away, a wharf with a sailboat moored alongside indicates how the ore and other supplies were brought upstream by the rising tides of the Saugus River and the finished product, in turn, floated downstream to market. And if stream and sailboat seem small by today's standards, one is reminded that a century later nearby Salem was founding its great fortunes on the cargoes of ships of less than 500 tons.

Overlooking the entire project from a high bank, even as it did 300 years ago, is the one original building remaining—the ironmaster's house. There the First Iron Works Association, Inc.,

makes its headquarters and Miss M. Louise Hawkes, clerk of the corporation, has her office. The directors hold their meetings in the great front room whose windows frame a view of the plant, and they have even been known to enjoy a dinner cooked in the huge fireplaces.

The Saugus ironworks was organized in 1646, and early in the 1650's was in as full production as it ever attained. A marker that stands near the ironmaster's house records that "The Company of Undertakers for the Iron Workes, consisting of English Gentlemen and Colonists, erected a furnace on this site." The English gentlemen were merchants, ironmasters, tailors, professional men and others. Their object was to supply the settlers with pots, pans, nails, bolts, chisels, mattocks and other useful articles. They hoped that the venture would be profitable, but it wasn't, and it lasted only twenty years. During that period the plant turned out a little more than a ton of iron a day for about 180 days a year. In winter operations had to cease when the 1000-acre reservoir, created by damming the river to obtain power, was froze over, but most of the employes kept busy relining the furnace, repairing the machinery and cutting timber for making charcoal.

The location, then known as Hammersmith, was about halfway between Boston and Salem, the two largest existing markets. The products were stored in a small warehouse near the dock and delivered to customers by either cart or boat. Some were sent to another warehouse in Boston and thence to England. Cast iron sold for around $200 a ton and wrought iron for $275.

The bog ore was limonite, soft and easily dug and loaded into carts. The fluxing rock was gabbro, which differed considerably from the limestone or sea shells generally used by the colonial ironworkers. Research indicates that a mixture of 60 percent of ore and 40 percent of gabbro produces slag of the composition found in the dump at Saugus. It is assumed that the proportions of the mix were originally determined by trial and error.

The blast furnace, around 21 feet high, was built of granite and other types of stone close to a hillside, with a connecting bridge over which men carried baskets of ore, charcoal and gabbro to charge the furnace from the top. Cams on the wooden shaft extending from the water wheel alternately depressed the two bellows, thus providing a more or less continuous blast of air. A wooden lever made it possible to control the flow of water over the wheel and thus regulated the volume of the blast. As a charge melted, the iron sank to the bottom and the dross or slag rose to the top, where it was skimmed off every fifteen or twenty minutes. After nine or ten hours the furnace was tapped and the molten iron run into depressions in the sand to form sows, or into ladles to cast stove plates, pots, etc.

To remove excess carbon and silicon, the sows were refined in two "fineries" and a chafery. They were first reheated in a hearth, where a high temperature was created by directing an air blast into the charcoal fire, and then kneaded into a ball or "loupe." The latter was removed with tongs, hand hammered to get rid of surplus charcoal and worked under a 500-pound hammer driven by water power to form a thick, square section. This was cut into two "half-

SOME OF THE WATER WHEELS

Seven water wheels that developed a total of 14 hp aided human muscles. A group of visitors (above) is watching a demonstration of the wheel that powers the blast-furnace bellows. The other picture shows a pitch-back wheel (left) that operates the forging hammer and a paddle wheel that operates a set of bellows at the chafery hearth.

ONE OF THE HEARTHS

A guide adjusts one of the heavy leather bellows (right) that forces air into a forge hearth and stokes a charcoal fire.

blooms," which were taken back to the finery to be "soaked" for an hour at moderate temperature in the bottom of the hearth. Each was next forged by the big hammer into a dumbbell-shaped piece and again heated. After that, the bulbous ends were reduced to the same size as the midsection.

Most of the wrought-iron bars produced were sold to blacksmiths and other ironworkers who fashioned them into tools and implements. Some went to the works' rolling and slitting mill where they were converted into flat stock and rods by passing them back and forth through rolls powered by water wheels and lubricated with animal tallow. These were either sold or reduced in the slitting mill to small-diameter rods that were in demand by farmers and blacksmiths for making nails.

From that simple plant, with its crude equipment, men went forth trained in the most advanced methods of producing iron then known—men who were to found more successful, ever-expanding ironworks in Rhode Island, New Jersey and elsewhere in the colonies. Occasional traces of old blast furnaces or charcoal kilns can still be seen along the banks of streams that once provided them with power. Under a succession of ironmasters and the continuing guidance of the blacksmith, Joseph Jenks, who among other distinctions received the first patent issued in this country, the mill developed processes—forerunners of modern high-speed practices—almost unknown elsewhere at that time.

The movement to reconstruct the ironworks was started by a group of Saugus citizens headed by Miss Hawkes. First they bought the ironmaster's house and the land it occupies and later the adjoining site where the ironworks had stood. Their dreams of restoring the historic buildings were realized after Quincy Bent, a retired executive of the Bethlehem Steel Company, became interested and, in turn, inspired the American Iron and Steel Institute to finance the project. It took six years to do the work at a cost of $1.5 million, and upon its completion late in 1954 the property was turned back to the First Ironworks Association.

Digging at the site was started in 1946, and archeologists soon uncovered sufficient traces of the ancient ironworks —pieces of water wheels, fragments of drive shafts and the remains of decayed sluiceways—to make reconstruction feasible. Tumbled foundations of old buildings provided exact dimensions for their present counterparts. A 500-pound hammer head, lying only a few inches below the surface, was a major discovery. In contrast, the 18-foot water wheel, which had driven the blast-furnace bellows, was located 21 feet beneath a heavily traveled street. It was sufficiently intact to serve as a model. More than 5 tons of other artifacts were literally sifted from the ground excavated during the research and construction operations. Many of these are now on display at the project museum, where one exhibit is labeled, "Can you identify these?" There pieces of corroded iron in strange shapes challenge visitors to "stump the experts" and thereby assist the researchers.

School children from surrounding towns early learned the fascination of helping to dig for hidden treasures at the Saugus site, and now go there regularly for a first-hand view of colonial industry and local history. Men interested in steelmaking flock to Saugus by the hundreds, and so do people whose ancestors were active in the founding and running of that pioneer ironworks. No iron is produced there now, but the water wheels turn and guides demonstrate how the various operations were performed and answer questions. The premises are open to the public every day except Monday from mid-April through November. Although no special effort was made to attract visitors while construction was in progress, more than 10,000 found their way there in 1953.

The American iron and steel industry employs some 650,000 people and supplies a world-wide market. In contrast, the Saugus mill numbered about 80 men, and never succeeded in turning out enough to satisfy its customers. Wages averaged twelve cents an hour for a 12-hour day (charcoal workers were the highest paid) and were relatively high for the time, but even so free labor gravitated to farms. The plant drew some of its workers from the ranks of Scottish indentured prisoners taken by Cromwell's army at the Battle of Dunbar and sent to the colonies as semislaves, a practice common in that day. Yet that early ironworks, which produced only 160 tons of iron in one of its best years, was, in effect, the ancestor of today's steel industry with its annual output of more than 112 million tons.

Compressed Air Dumps Slag Cars

AT THE DUMP

Cars (top) are dumped one at a time, using air stored in the receiver at the right end of the train. It is charged by a compressor in the housing next to it. J. W. Croom (above), switchman-foreman standing on the "off" side, operates a valve that admits air to the tilting cylinder of a car. At close range the spilling slag (left) puts on a spectacular pyrotechnical display. Old slag dumps, being processed into commercial stone, are seen at the right.

SLAG is a by-product of the conversion of iron ore into pig iron in a blast furnace. Separating molten slag and iron isn't difficult—the dross floats on top much like cream floats on milk. Only in this case the most important part is on the bottom. Getting the white-hot molten slag out of the furnace area and dumping it are more of a problem. At the Pueblo (Colo.) Plant of Colorado Fuel & Iron Corporation, for example, four times as much slag as iron, by volume, is produced. However, it weighs only three-fourths as much as the same amount of iron.

Slag-disposal methods practiced at the Pueblo Plant are safe and efficient, thanks to compressed air. The material is tapped every 30 minutes—except immediately after a cast when about two hours elapse—and is run directly into slag pots of from 12 to 20 tons capacity. These are made up into a train (the number of cars varies with the casting schedule) that is pulled by a diesel locomotive to the slag dump where air cylinders tip the pots to discharge the molten dross. This is done by a switchman who walks along the off side—that opposite the dump—and manipulates a valve on each car.

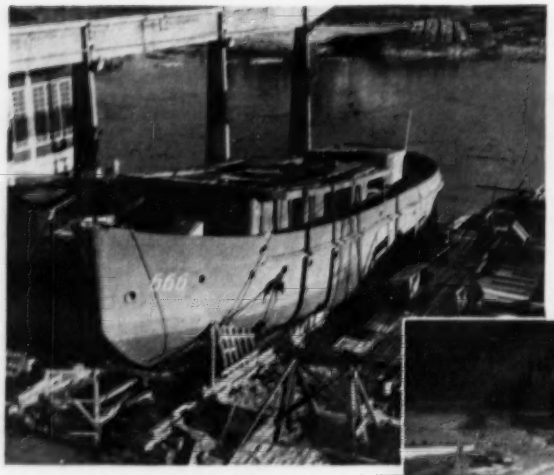
Then the train is run to another part of the dump where the cylinders are operated repeatedly to slam the pots against the frames of the cars. The jarring loosens the solidified layers of slag known to steelmen as "skulls." Trains make ten to twelve trips a day, and the amount of slag handled may reach as high as 2000 tons in a 3-shift day. Some iron inevitably gets mixed in with the slag, but it coagulates into rounded chunks or "buttons" most of which are picked out mechanically after solidification and returned to the furnaces.

Slag no longer remains useless; in recent years more than 29 million tons has been processed in one way or another in the United States. Part of it, for instance, is crushed and used as aggregate in concrete or bituminous-mix for road construction and other purposes, while some is remelted and converted into a fibrous material that finds application as thermal insulation.

Air Power Helps Finns Build Boats

A. Ahlstrom Company, one of the nation's largest firms, uses pneumatic shortcuts at Warkaus

HANS BRANDERS



HULL AWAITING LAUNCHING
Component parts built up in the fabricating shop are transported to either of two ways by crane and assembled there. The yard specializes in all-steel tugboats the largest of which has a deadweight of more than 120 tons.

SHOPS AT WARKAUS
This engineering works and shipyard is operated by one of the largest concerns of its kind in Finland and normally employs 900 persons.

FINLAND'S economy is based largely on manufacturing because only a very limited percentage of its 130,165 square miles is suitable for agriculture. "The land of a thousand lakes," as it is known, has a long register of industrial establishments for its size, and of these one of the largest is A. Ahlström Osakeyhtiö (the last word meaning company). This privately owned concern is somewhat unique in that it is engaged not only in many enterprises but also designs and builds nearly all the machinery for them. In addition to operating sawmills, pulp and paper mills and plywood and wallboard plants, it also owns glass factories, engineering works and shipyards and erects steel bridges.

Our present interest is focused mainly on the shops, foundry and shipyard at Warkaus where approximately 900 men are employed in fabricating sheet metal, light and heavy plate and structural steel; in constructing cranes, conveyors, high-pressure boilers of the forced-circulation type, miscellaneous machinery and steel vessels up to 120 feet long. To relieve the heavy load this diversified program imposes on the engineering and designing department, as well as to keep abreast of the latest manufacturing developments and practices, close contact is maintained with similar industries abroad, especially those in the Scandinavian countries.

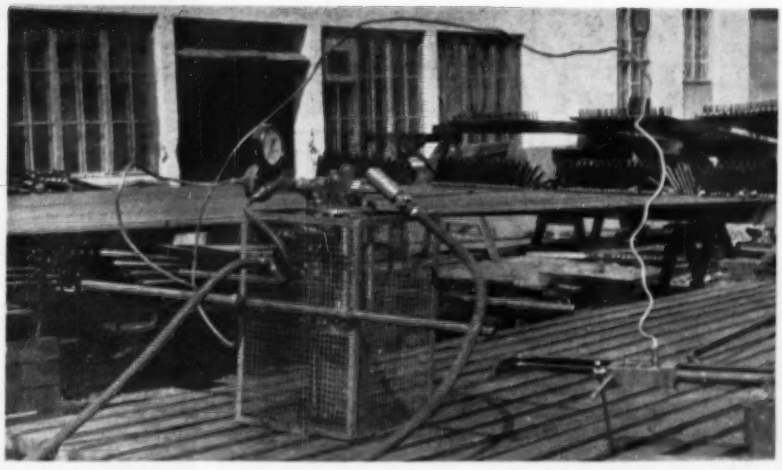
In plants such as that at Warkaus, which are mainly engaged in the fabrication of structural steel and allied operations, the work of assembly was formerly done for the most part with rivet hammers which called for the use of a considerable amount of compressed air. But with the introduction of electric-arc welding and oxyacetylene cutting, the physical appearance of machine shops of this kind changed completely and it was believed in some quarters that they would have little need for air power in the future. However, that is far from the case. As a matter of fact, its use as an auxiliary means of production has increased measurably.

It is not our intention to enter into the varied applications of compressed air at the Ahlström engineering works but to describe only two which are believed to be uncommon and therefore of interest. One is connected with the construction of standardized tugs of different sizes, the largest having a deadweight of more than 120 tons. The hulls are welded according to the latest methods and assembled of prefabricated parts weighing up to 10 tons, the weight being limited by the capacity of the cranes which transport the components from the shops to the parts storage yard and shipways.

The entire plant is laid out to expedite the flow of materials, which arrive by rail and are transferred to a storage area by a 5-ton traveling crane that also carries them as needed to the adjoining plate prefabricating bay. The latter is equipped with up-to-date facilities, including plate shears and straightening rolls and a large oxyacetylene cutting machine. Parallel to this section is the main fabricating bay which is 330 feet long, 66 feet wide and has two traveling cranes of 10 and 25 tons capacity. This is where the prefabricated members of the tugs and their all-welded boilers are assembled. Upon completion, the work is moved outdoors on low flatcars and picked up by a 10-ton crane which, together with another of like capacity, serves both the parts storage yard and the two shipways beyond, an area 60 feet wide and 420 feet long.

The standard procedure in building the vessels is to divide the hull into the following sections: stern, bow, bottom, decks, sides and transverse and longitudinal bulkheads. It is in the assembly of the components of these different units that the first of the novel air applications comes into play. The work is performed by the aid of two specially designed fixtures consisting of a 2-part welding base fashioned of channel bars and hinged lengthwise in the center. Surmounting each structure are two "gantries" that move on rails laid at floor level on both sides. Each travels on its own track so that the two units can be brought close together and is equipped with either six or eight vertical air-powered cylinders with long-stroke pistons. The latter are provided with sizable footpieces which are brought to bear, as required, against the plates or hull components supported by the base. Each cylinder is, of course, operated independently.

When bulkheads are assembled, the



AIRHYDROPUMP

This portable unit is equipped with a differential air piston to develop pressure in a hydraulic cylinder for use in testing boiler tubes. A reducing valve on the air inlet line permits varying the final pressure over a considerable range. In this case pressure is being transmitted through copper tubing to a piece of pipe undergoing test at the lower-right. Other pipes to be checked for soundness are in the background.

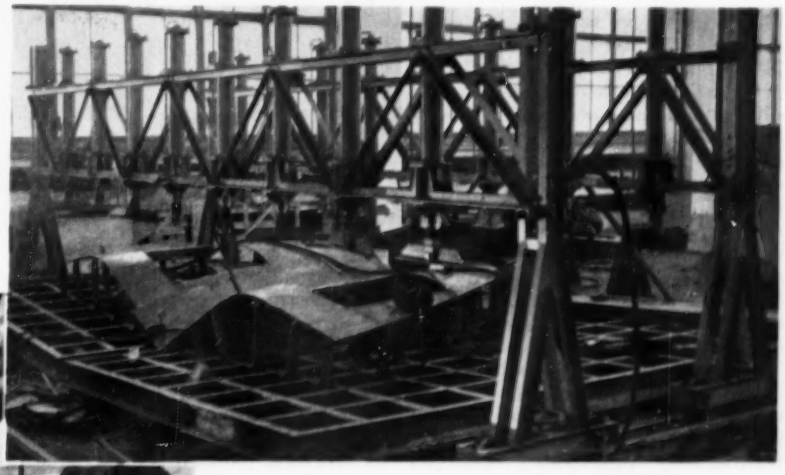
plates are laid on the base and the stiffeners and stringers are added. Then the structure is clamped securely and welded. In the case of bottom plates, the two leaves of the base are placed at an angle that closely approximates the contours of the hull, with the keel extending along the axis of the hinges. After that, upright brackets are temporarily tacked to the base and the hull plates are laid on them with the aid of templets or patterns for assembly by butt welding.

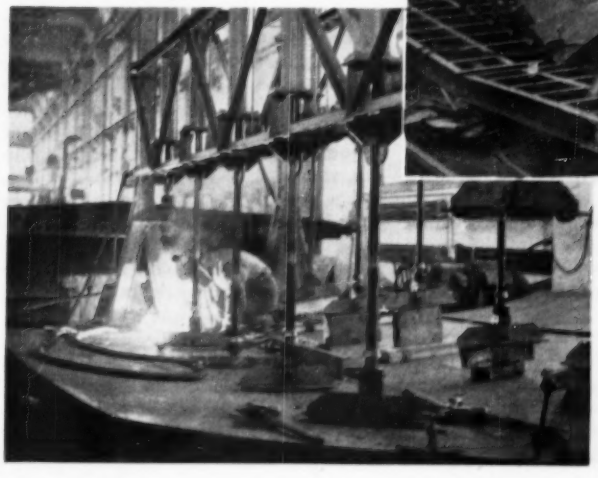
Now we come to the second of the air applications, which concerns the high-pressure boilers for the tugs. These are composed largely of tubes of small inside diameter—about 1 inch—with a wall thickness of around ⅛ inch. A unit of medium size, with a steam-generating capacity of 80 ton/hour, requires more than 10 miles of tubing all of which is bent on the job, welded together in flow groups of different sizes and arrangements and tested under pressures up to 100-150 kg/cm² (1422-2133 psi). This phase of the operations is important and is carried on continuously in the course of manufacture.

Formerly a hand pump was relied upon to supply the necessary pressure; now airhydropumps are utilized to great advantage. They are an economical answer to virtually all problems involving static hydraulic-pressure testing. The type in service is compact, portable and functions automatically. It is provided with a special air reducing valve that makes it possible to obtain any intermediate hydraulic pressure, which can be maintained indefinitely.

The basic components of the unit are a double-acting air cylinder the piston of which is coupled to a moving hydraulic cylinder. Extending into the latter is a stationary hollow ram that is connected to the liquid inlet and delivery valves. Because the area of the air-cylinder piston is bigger than that of the ram, the pressure that builds up in the hydraulic cylinder is proportionately greater, causing the pump to operate until the load in both cylinders is equal. At that stage pressure remains constant without the use of air until the balance is disturbed and the pump again starts its reciprocating action. The boiler-tube system undergoing test is linked to the pressure line by a quick-connect coupling.

Air for the engineering works is supplied by a group of stationary compressors of which the oldest is an Ingersoll-Rand machine that was constructed in 1902 and is still giving excellent service. For building steel highway and railroad bridges, which calls for the use of rivet hammers, the company also maintains portable units of different sizes including two of the Ingersoll-Rand type.



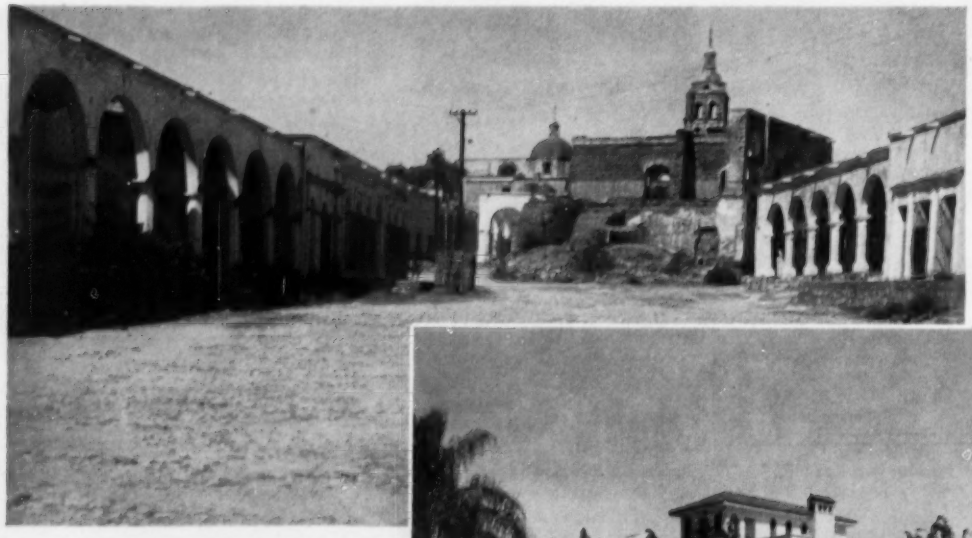


NOVEL CLAMPING DEVICES

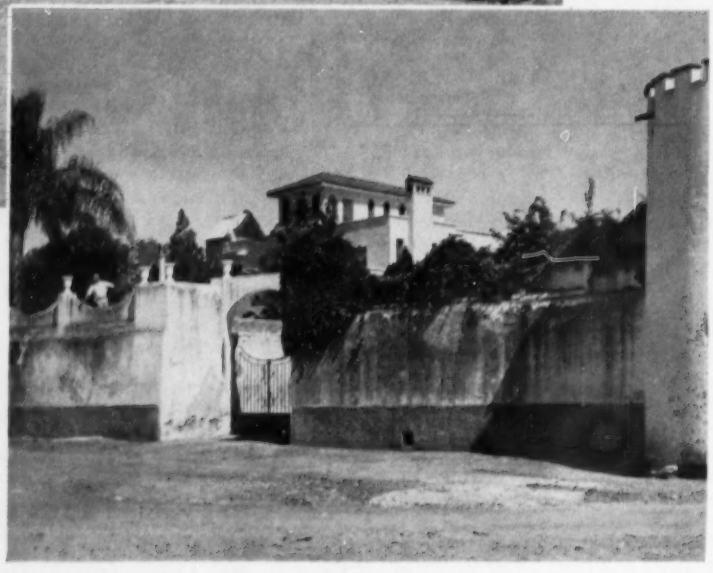
Tugboat components are welded while resting on either of two special fixtures made up of channel bars and hinged in the middle. Each is surmounted by two "gantries" that travel on rails (above) and carry six or eight vertical pneumatic cylinders that clamp the work in position. The cylinders are movable on the gantry trestles, and as each can be operated independently of the others they offer a flexible arrangement for holding down variously formed members during the welding process. The picture at the left shows the cylinder rams extended while a welder works on the bottom plate of the stern section of a hull.

BEAUTIFUL

Bells of Aduana in the tower of old mission. At one time Aduana, which is seven miles from Alamos, led the world in silver production



Everywhere in Alamos gorgeous buildings ignore the ruins of others beside them



Grand "quinta" built by General Macias, a former governor of Sonora. It is now occupied by American mining men, one of whom, Nelson Calley, is on the wall

MINING made a city of Alamos, Mexico, soon after Nuna Guzman first camped there in 1531. The Spaniards discovered veins rich in silver and almost as rich in gold. Hungry for precious minerals, and finding a disappointing amount elsewhere, they kept opening up one deposit after another in the area. But they forced the local Mayo and Yaqui Indians into slavery in the mines until, in 1734, they rebelled in savage attacks. Drought and famine helped to kill off invaders and Indians alike and nearly depopulated this southern end of the State of Sonora.

It took the Spanish nearly half a century to make a strong comeback. They reopened many of the workings and built up Alamos from its rubble. Some years as many as 2000 bars of silver were shipped to Spain. Much of this metal came from the great mines at Aduana, 7 miles out of Alamos proper, where it was smelted and then carried by burros and Indians to the nearest seaport. Parts of the old smelter still stand at Aduana which, like Alamos, is now mostly in ruins. But it still has its ancient church, its pretty little plaza with running water in a fountain and a couple of stores where the native people buy the few things they need.

Legend persists that when the government at Mexico City exiled the Jesuit fathers from Alamos they induced the inhabitants to fill the tunnels with stones. The work was done so cleverly, according to the stories, that many of the mines have never been found again by white men. And white men are still searching for them.

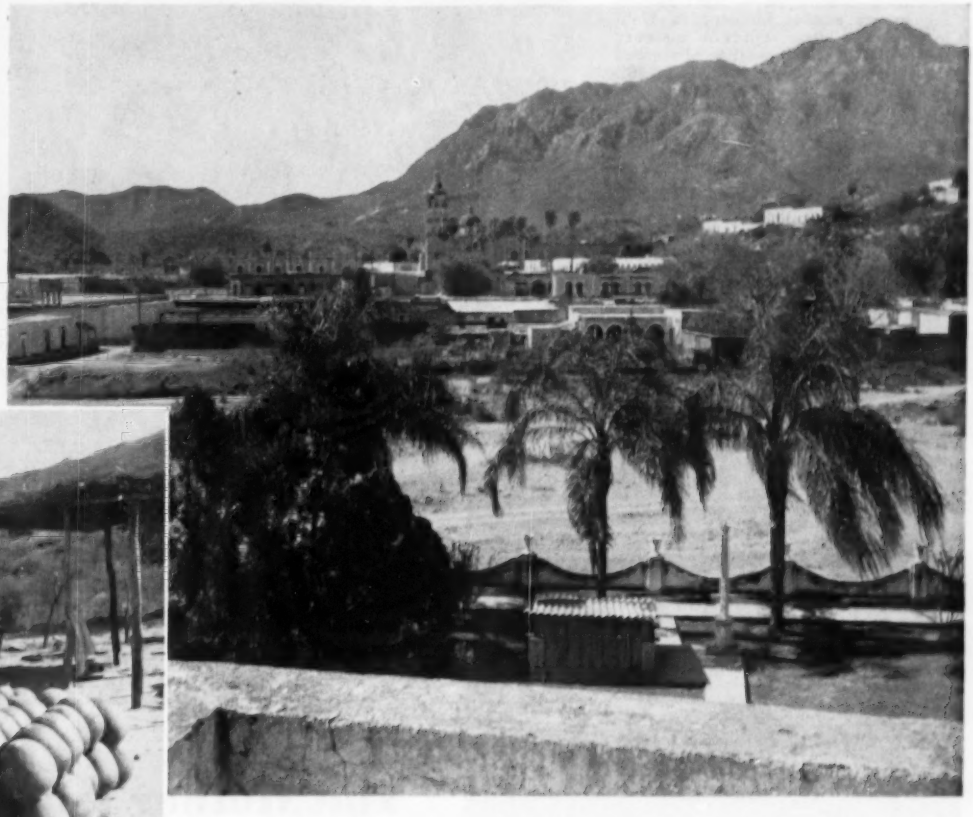
American tourists have discovered Alamos since the building of a paved road down the west coast of Mexico. Some 451½ miles from Nogales, Ariz., more sight-seers are coming each year, but still not enough to change Alamos from its quiet, waiting sort of life—not enough even to cause English to be spoken in any of the small shops or to bestir anybody to put in a filling station. Gasoline is available at only one place and is pumped from a barrel into a measure and then filtered into your tank through an old felt hat. But you'll like the young fellow who gives this service, a Los Angeles-born GI who has cast his lot with the people of his grandparents.

Many of those living in Alamos have relatives in Los Angeles, direct or remote, for Alamos was the mother colony of that city when it was getting its start in 1781. Through all the intervening years the kinship has continued between the people of Alamos and the Spanish-speaking citizens of Los Angeles.

Mining may again give Alamos a payroll. Within the past year a small group

ALAMOS

CLEE WOODS



Alamos is sheltered by desert mountains

At the potters' village of Uva Lama

of Americans has arrived for the purpose of reviving some of the old workings in the region and also with the intention of breaking down the solid barrier which the Yaqui Indians have set up against all white men—Americans and Mexicans alike—at the edges of their land back in the high Sierra Madre Mountains. One of this party of six, most of whom speak Spanish fluently, has made friends with the Yaqui headman and obtained his permission to prospect back in the wild Yaqui country. Of course, uranium will be sought, as well as gold and silver.

But local Mexicans are skeptical about this venture of *los americanos* into Yaquiland. They say the friendship won't last, especially if the Americans find something and begin mining. I'm inclined to agree with them — am afraid that the wham of rifles will soon follow the purr-r-r-r of compressed-air drills on the mountainsides.

Anyway, the group has leased, with option to buy, the finest house in Alamos —a beautiful *quinta* built about twelve years ago by General Macias, a former governor of Sonora. The mansion stands inside typical high Mexican walls that enclose eight acres of land and is to be headquarters for the miners who have little truck with the tourists who come to Alamos. They're there for business.

Across the arroyo from the *quinta* the visitor finds a paradise in winter—a wonderful sunny climate, friendly people, two comfortable little hotels operated by Americans for Americans, and a lovely desert countryside often sprinkled liberally with a great variety of flowers of many hues.

No Mexican city has ever been built with such a community oneness in beauty. Even as street after street in the city melts slowly into more complete ruins there is charm in the old houses. Artistic arches, patios, portales and flowers everywhere—the poorest Mexican has her flowers, and perhaps her canary or parakeet. In February the bougainvillea vines are gorgeous bowers of color.

A few families from the States have bought old mansions—grand structures with inviting patios and hallowed with history. The prices are so low, so tempting. A thousand dollars—two thousand—never more than ten thousand. But when an American gets through restoring and modernizing he has a substantial amount invested, with tenure of title uncertain and living conditions something short of paradisiacal.

But as a place to go and see, or a winter resort for a month or so, Alamos is truly magnificent. It may be on the eve of a rebirth, some 3000 people now as compared with a peak of 30,000 in its heyday. The gradual increase in American visitors and a mining revival could bring back this little city that once was the silver capital of the world.

GOLD HILL MINE IN 1855

A drawing by George Mathis, a commercial artist in the Grass Valley section, of the Gold Hill Mine as it might have looked a century ago. In the center and lower-left is the surface mechanism of the Cornish pumping engine that lifted water from the workings. It was manufactured in England, transported around the Horn to San Francisco and thence overland to the mine. There are indications that the pump was steam driven. Mr. Mathis reconstructed the scene from old photographs and descriptions.

DISCOVERY SITE

Monument commemorating the discovery of gold on Gold Hill by George Knight in October 1850. This find is generally considered to have started the quartz mining industry in California. The stone stands on masonry that was once the foundation of some of the surface equipment of the Gold Hill Mine, which was credited with a production of $4,000,000 between 1850 and 1857.

The Mother Lode Today

ALONG the Mother Lode country of California the gold-mining industry presents a sad picture. In many isolated spots you come across what was once a busy gold mine; now you find the remains of the headgear, and in many instances even that has disappeared. Somehow, it gives you a feeling of sadness as you try to visualize the activity that once must have gone on there and you think of all the labor that was expended to bring the huge equipment over rough mountain roads by wagons. Today, if you question a few old-timers they will tell you that some of the mines were in ore when they were shut down.

While there are still several producers in the Grass Valley district they are operating at a considerably reduced pace, and it is questionable whether gold mining will come back with the price of the yellow metal pegged at its present level and with the high prevailing labor and material costs. Attention has recently turned to logging, and in place of ore wagons you see diesel engine-driven heavy-duty trucks hauling large quantities of timber over highways to sawmills. No doubt this has offset the decline in the mining industry. Of course logging will reach a limit, but with the present transportation facilities it is possible to bring timber from great areas within easy range of ready markets.

There is much of romantic interest in Grass Valley. Inasmuch as the hard-rock miner came to the district in October 1850 it was settled before the discovery of gold quartz. Many small farms were being operated when placer gold was found in the creeks and old river channels. Now there are great scars where millions of tons of gold-bearing gravel was dislodged and washed away.

The hydraulic miner made excellent use of the available waterpower in sluicing banks of gravel into the famous "long tom" gold-catching devices that were developed in the region. In January 1884 this method of placering was restricted by the state because of the debris that was carried down into the valleys and rivers. It is interesting to follow some of the creek beds and see the heaps of stones left along the sides. The Chinese played a big part in this work, and old reports indicate that they were more thorough than our countrymen.

There was also plenty of tragedy in the early mining days. On the sad side was the case of the Brennan family of Grass Valley. Brennan, a man in his thirties, with a wife and three small children, ran out of funds to continue his operations. With his properties mortgaged to the limit and with his credit exhausted, he concluded that life was not worth living. Neighbors, alarmed at not seeing the family around, broke into the house and found all five dead of prussic-acid poisoning. An ironical

NATIONAL HOTEL, NEVADA CITY

Stagecoaches once stopped here to drop or pick up passengers; now Greyhound buses do it.

angle of this episode came to light when the holders of the mortgage on Brennan's mine on Gold Hill drilled one round and obtained rich ore. Brennan had quit one day too soon.

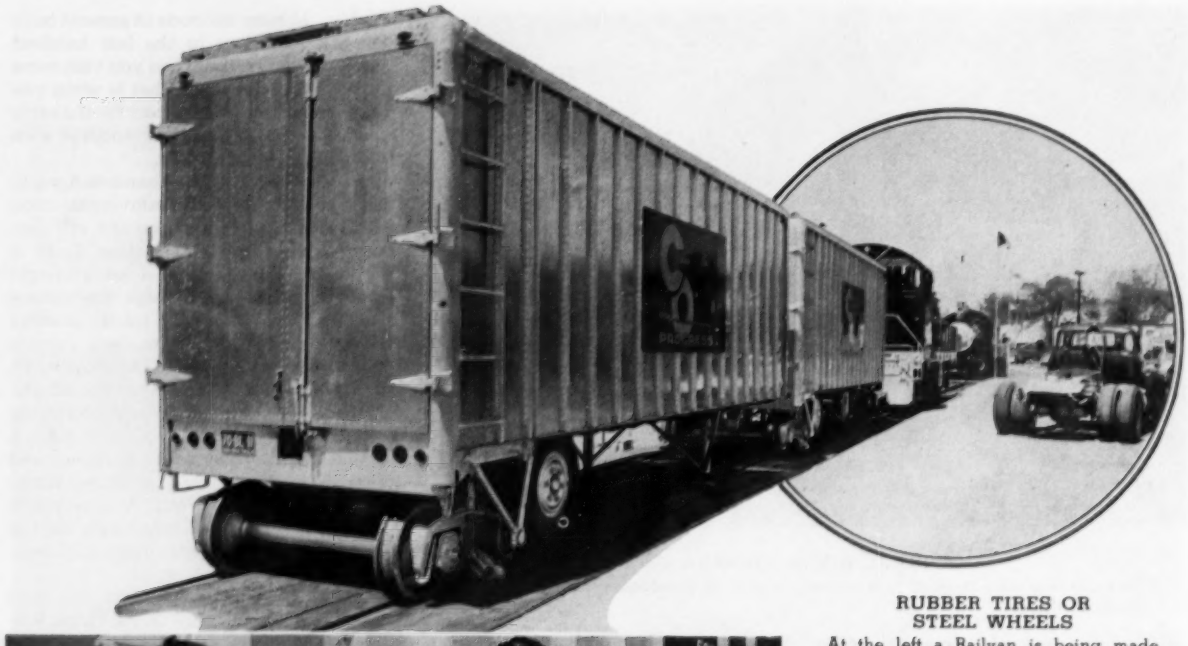
One of the outstanding pieces of equipment in the lode mines of that day was the Cornish pump—the marvel of its time—that was used for dewatering the workings. Few of them are left; most of them have long ago been sold for scrap. The machine had long wooden rods made from 6- to 15-inch timbers and was driven by a surface pump jack or walking beam that was often counterbalanced by a weight of 30 to 40 tons. At the Combination Shaft, Virginia City, Nev., a vertical pump rod, 15 inches square and more than 3000 feet long, operated a double line of 15-inch plunger pumps at a maximum of 6½ strokes per minute, the stroke being about 7½ feet at the surface. Some of those old machines were brought from England in sailing ships that went around the Horn to San Francisco and then by wagons over rough mountain roads to their destinations. The modern high-pressure multistage centrifugal pump for mine service, though a small package compared with the old Cornish type, is many times more efficient and of greater capacity. Mining methods in general have come a long way in the last hundred years, as you realize when you visit some of the old properties. That is when you acquire a wholesome respect for the early miners who accomplished wonders with the equipment they had.

Despite the district's abandoned workings and the current unfavorable conditions for gold mining, no one will venture to say that the Mother Lode is finished. There is still a lot of virgin ground around and always the chance that new strikes will be made, possibly including some of the modern miracle metals that are needed in the atomic age. The Brunswick Mine, one of the Idaho-Maryland group, is already producing and milling tungsten ore, but with a smaller force than when it mined and processed gold ore. The Idaho-Maryland itself is shut down. A mere handful of workers maintains a lonely vigil in the office, but the hoist house and compressor room are silent.

Figures compiled in 1933 list gold output up to that time in the Grass Valley-Nevada City and Rough and Ready mining districts, all in Nevada County, at $193,850,000. By districts, the three accounted for $148 million, $44 million and $1,850,000, respectively. The Empire-Pennsylvania with $50 million, the North Star-New York Hill-Massachusetts Gold Hill group with $45 million and the Eureka-Idaho Maryland with $27.5 million were the leaders. All are in the Grass Valley District. The Champion-Providence-Wyoming group, with a yield of $25 million, was ahead in the Nevada City area. Production of some of these mines continued high during the 1930 depression years, but virtually ceased in 1942 when the Government declared gold mining nonessential to the war effort. Attempts to revive the industry since then have met with little success.

GRASS VALLEY SCENES

Part of the shopping district of Grass Valley and the headframe of the Idaho-Maryland Mine, which is now idle.



RUBBER TIRES OR STEEL WHEELS

At the left a Railvan is being made ready for coupling into a train. It has been hauled into position as a highway trailer and spotted over the track. A research engineer for the railroad is about to operate the valve which will cause air cylinders to lower the steel car wheels and retract the pneumatic trailer wheels. The other picture shows two Railvans coupled to a train. Note the running lights and license plate of the rear unit, which contrast with the side ladder and steel wheels. The grillwork just visible at the top edge is the walkway customarily seen on rail equipment. Right below the doors is a square opening which contains the coupling. Standing at the right is a tractor waiting to deliver one of the cars of freight to the consignee as soon as it has been converted into a trailer.

THE CHESSIE'S RAILVAN

With a Few Minor Adjustments, Hybrid Vehicle Can Travel Either Rails or Highways

PIGGYBACKING was developed by some railroads as the answer to customer complaints that rail transport was too slow because of delays in handling shipments at terminals. It was determined by the Chesapeake & Ohio Railway, for example, that the average freight car was on the move only three hours each 24-hour day, the remainder of the time it was tied up at terminals or on sidings. It was reasoned that a flatcar carrying a truck-trailer could not only move goods from one city to another at the low cost and high speed of long-haul rail traffic but also by-pass freight yards by towing the trailer directly to the consignee rather than transferring goods from car to truck and thence to their destination.

When tried out in line service, piggybacking showed great promise, but there was still the problem of availability of flatcars and facilities for loading and unloading the truck-trailers and blocking them on the cars. In an effort to overcome these shortcomings the Chesapeake & Ohio, familiarly known as the "Chessie," has come up with experimental models of a combination vehicle designed for both rail and highway operation. Designated as the Railvan, it is a hybrid affair incorporating steel wheels and rubber-tired wheels for rail and highway travel, dual running gears complete with brakes, couplings for rail service, a standard "fifth wheel" for truck haulage, as well as the ladders and overhead walkways of a freight car and the running lights and signals of a truck.

The vehicle resembles a trailer more

ADAPTER CAR

A Railvan coupled to a standard diesel-electric locomotive by an adapter car. One of these units is also used when a caboose is to be added to the train or a single Railvan is to be interposed in a line of standard freight cars. Service lines for the train are carried in the couplings which, together with the lines, lock automatically on contact.

than a rail car, and loading is done through full-width rear doors that open in the center. Couplings are of the male-and-female instead of the universal type and lock automatically on contact. However, when hooking a Railvan onto a freight car, caboose or an engine, a short adapter car with a standard coupler on one end and the special coupling on the other must be used. The latter is designed to take vertical loads as well as draft force so that the front half of each is carried on the suspension of the next forward car (or adapter) in line.

The Railvan can be converted from one service to another simply by manipulating a valve controlling an air motor. Compressed air was chosen as the operating power because both trucks and trains have ample supplies available. In changing from highway to rail suspension, the steel wheels are lowered onto the track as the rubber-tired wheels are retracted. Spotting the trailer on the rails is said to be no more difficult for a competent driver than, say, spotting it on an unloading ramp in a terminal. A special locking device is used to hold the suspension in any desired position. After the steel wheels are set, the dolly wheels of the trailer are lowered for disengagement of the tractor and the car is added to the train. By reversing the steps, the Railvan is converted to highway duty.

Because of clearance problems, the truck tires are smaller than usual, are Size 10.00-15 known in the trade as Low Boy. Needless to say, C&O engineers ran into many difficulties in designing the vehicle, and not the least of them was that of weight. To take the pounding of thousands of miles of long-haul rail service it was necessary to have a heavy-duty unit of typical railway durability; on the other hand, excess weight is penalized by a reduction in payload to meet weight limits in effect on highway systems.

The use of new lightweight metals helped to a certain extent; borrowing a few features from modern trailers also cut down the weight somewhat; but design engineering did the biggest part of the job by making each part, including the thin aluminum covering, serve as a structural member. The result is a trailer-rail car not much heavier than a standard highway trailer.

Brakes on the new vehicle are operated by compressed air whether it is on the track or on the highway. When serving as a trailer, air power is applied to actuate the brakes; when riding on rails, the principle is reversed—release of air causes springs to set the brake shoes the same as in the case of a standard freight car.

The Railvan has an overall length of 29 feet 3½ inches, is 8 feet wide, weighs 10,500 pounds when empty and 38,000 pounds when carrying the maximum load. Its height when on rubber tires is 12 feet 3 inches; its clearance on steel wheels is 11 feet 7 inches. It has been sanctioned by the Interstate Commerce Commission as both a rail and a highway vehicle.

They're Always Digging Up New York

NEW YORK CITY is one of the most "dug up" places in the world. Street excavations, always in evidence, increase sharply every spring and summer. Eighty percent of the holes are made by utility companies. They don't relish the criticism that harassed motorists heap on them, but retort that "the day you don't see those holes, you'd better look to your pocketbooks, because hard times will be coming."

A permit must be obtained from the office of the borough president involved before a street opening can be dug in any of the city's five boroughs. Last May protests from drivers caused Borough President Jack of Manhattan to suspend for two weeks the granting of permits for any work not absolutely necessary. At the time a map of the borough in his office was studded with 1000 pins, each of which marked the location of a street excavation. During the first four months of the year around 4000 permits had been issued.

The city itself is quite a digger. This year, for instance, it plans to lay 50 miles of pavement, put in 60 miles of new sewers and 50 miles of water mains, aside from traffic-control installations at 200 street intersections. The utilities, however, far outstrip Father Knickerbocker. The Consolidated Edison Company, which supplies steam, gas and electricity, has budgeted $8.3 million of underground construction for this year—about double the annual figure five years ago.

Although they tear up the streets a lot, the utilities conduct most of their underground operations through manholes that give access to pipes, conduits, etc., already in place. Since the state legislature, in 1884, ordered that all their lines be laid under the streets, the number of manholes has grown to the astounding figure of 683,000. Beneath the surface are 15.5 million miles of telephone wires (500,000 more miles will be added this year), 19,800 miles of electrical ducts, 7000 miles of gas lines, 5500 miles of water mains, 5000 miles of sewers, 2200 miles of television circuits, 87 miles of high-pressure steam lines and an untotaled mileage of pneumatic tubes.

Wherever an excavation is refilled, a pavement scar remains, and no matter how carefully the backfilling is done, some subsidence is likely. Last year 18,760 street-surface repairs were made in Manhattan Borough alone. Of these, 10,550 involved openings dug by utilities and the 8210 others were the result of normal wear.

DRAWING BY ANDREW SVACHAK

Something About Mushrooms

TRUE lovers of mushrooms rarely ever get enough of this wholesome food. They eat them on steak, in soups and stuffings, and sometimes just by themselves. For years the mushroom has been in the luxury class, but in the days of feudal kings the so-called socially elite scorned the lowly fungus as food for pigs and peasants. Recently it has been more closely examined by scientists and some new facts about its growth and life have been turned up.

For all of its delicacy, the growing mushroom is really quite a powerhouse when it encounters something in its path. There are several well documented stories about them pushing their way through asphalt and concrete walks and pavements. There is also a humorous but unverified account about one of supersize that forced its way through the floor of a Russian ordnance plant. It was during World War II, so the tale goes, when the first signs of an intrusion of some kind was noticed there. The NKVD (secret police) was promptly called in to counter what was suspected as an attempt by saboteurs to tunnel into the factory. Several well-armed men were posted around the bulging spot on a 24-hour watch that continued until the innocent mushroom finally poked its head through the shattered floor.

The investigators have been studying the mushroom from a medicinal point of view, and there is a possibility that some varieties may be valuable sources of antibiotic drugs. The common belief that mushrooms are of little value to the body already has been refuted. On the contrary, they are a rich source of "B" vitamins and also contain plentiful quantities of all the amino acids humans are known to require.

One of the latest developments of the present research is a new way of cultivating mushrooms that may result in their becoming a staple foodstuff. At a meeting of the American Chemical Society in Dallas, Tex., early this spring, Seymour S. Block, an engineering professor at the University of Florida, reported success in his attempts to increase the rate of growth and number of crops obtainable in a year. Instead of conventional culture beds compounded of compost and straw, he mixed sawdust and oatmeal and achieved some rather startling results.

One ton of the new bedding produced 500 pounds of the fungus in only eleven days, thus making it possible to garner about one harvest a month instead of the usual three to four annually. Moreover, Block asserts that mushrooms will sprout and thrive at temperatures as high as 78°F in the new culture medium, whereas straw-and-compost beds have to be maintained at less than 60°F. (Worked-out mines and caves have long been favored by growers because of their uniformly cool year-round temperature and also because of the absence of light—which is likewise a requirement.) Still another advantage would accrue from the use of the new bedding, for it could mean the consumption each year of as much as 75 million tons of sawdust, now largely wasted.

In the course of their investigations the scientists have discovered the reason for what are known as "fairy circles," that characteristic ring-shaped pattern in which wild mushrooms grow and which has led to the charming children's tale that fairies plant them in a circle so that each will have a ready-made seat when they hold their nocturnal conclaves. Research has proved that the rings are caused by one or two growths spreading their "root" structure or mycelia below the surface. As the nutrient in the soil is exhausted around a common center, the progany of the original plant are forced to range farther afield for food and do so in an ever-widening circle. One particular type—*Marasimus oreades*—displays this tendency more markedly than others. It is said that a *Marasimus* ring may expand from five to nineteen inches a year. In fact, aerial photographs often show up rings of exceptionally large diameter which cannot be seen from the ground because of their great size. From these observations it has been concluded by some of the investigators that certain large formations had their beginning 400 to 600 years ago.

Banked Blast Furnace in a Cocoon

AT THE winter meeting of the Blast Furnace and Coke Association of the Chicago District it was reported that the practice of "mothballing" battleships has been applied successfully to a blast furnace shut down temporarily. When Inland Steel Company banked its No. 2 Furnace at its East Chicago works for an indefinite period, the entire lower section or bosh was sealed airtight in a vinyl-plastic envelope. The low viscosity material was sprayed on hot in five successive webs and layers to a total thickness of $1/16$ inch, the final coat overlapping the brickwork, tuyere openings and bosh bands in order to insure tightness.

The work was begun one hour after the furnace was shut down and completed in 54 hours using four spray guns. Fifty-five days later, the rubberlike cocoon was removed by slitting it with a knife and stripping it off or by melting it with a gas torch. When the furnace was blown in after being banked for nearly eight weeks the coke in the lower part of the bosh was still in good condition.

Editorial

STEEL AGE 100 YEARS OLD

IN 1847, at Eddyville furnace in Kentucky, William Kelly blew cold air through molten pig iron to make a less brittle metal. That was the beginning of the pneumatic process of making steel, for which Sir Henry Bessemer is best remembered. Kelly was undoubtedly first, but he failed to follow through and consequently was never given full credit for his discovery.

Bessemer, who lived and worked in England and was unquestionably unaware of Kelly's invention, applied for a patent on the process in 1855, whereas Kelly did not seek one until 1857. However, Kelly's claims were given some standing by the United States courts as he was able to prove that his investigations preceded Bessemer's.

Daniel J. Morrell, a leading ironmaster of his day, helped finance Kelly's first commercial converter in 1861. Little larger than a 2-bushel basket, it was used by the Cambria Steel Company at Johnstown, Pa., and is now in the office building of Bethlehem Steel Company, which later acquired the Cambria operations. James Park, Jr., a prominent manufacturer of crucible steel in the 1860's, was a partner in the Kelly patents for a time. He later introduced to America the open-hearth furnace that has now largely superseded the Bessemer converter. Kelly thus seems to have had a fair start on the way towards establishing his invention but, lacking funds to carry on litigation with the Bessemer interests, made a settlement under the terms of which he agreed to remove himself from further contention.

Bessemer, a prolific inventor who was born in 1813 and lived until 1898, did not announce his revolutionary creation until August 1856 when he read a paper before the Cheltenham meeting of the British Association. The centenary of the Bessemer converter is accordingly being observed this month.

The converter was of enormous industrial importance and ushered in the epoch of steel. Means of making steel had been known for a long time, but they were of the small-batch type, slow and rather unwieldy. The Bessemer method greatly reduced the manufacturing cost and made available large amounts of "mild" steel that immediately took over the market for certain applications. It was first used on a big scale for railroad rails, which had previously been made of iron.

Largely because of the appearance of the metal, rail output in Great Britain rose from 110,000 tons in 1868 to 1,700,000 tons in 1888. In the United States, 460,000 tons of iron rails were sold in 1867 for $83 a ton. Only 2550 tons of Bessemer steel rails were available, but they were so much in demand that they commanded prices up to $170 a ton. By 1884 no more iron rails were being produced in this country and 1½ million tons of the Bessemer-steel variety were sold for an average of $32 a ton.

Bessemer made his discovery while trying to improve the steel used in manufacturing cannon. Pig iron, the product of smelting iron ore in a blast furnace with coke for fuel and limestone for flux, contains various impurities in quantities depending upon the composition of the ore. They are commonly carbon, silicon, sulphur, phosphorus and manganese. They can be eliminated or reduced by oxidation, and older refining methods introduced oxygen in the form of iron ore, iron scale, iron-silicate slag, etc. That was a tedious way of bringing about the desired result.

Bessemer somehow conceived the idea of supplying the oxygen by blowing air through the molten metal. When he tried it he was surprised to learn that it not only purified the iron but, instead of "freezing" it, also kept it highly fluid because it generated heat. The whole reaction required but a few minutes. Bessemer's patent was titled: "A process for producing malleable iron and steel without the use of fuel."

During the process, the oxygen in the air combines with some of the iron to form iron oxide. This reacts with the carbon, silicon and manganese in the hot metal and "burns them out." The carbon goes off as carbon monoxide, which becomes dioxide because it takes up more oxygen at the mouth of the converter; the oxides of manganese and silicon form slag.

Bessemer happened to conduct his first experiments with Swedish iron ore, which contains little sulphur or phosphorus. When others tried British ore, in which there are appreciable quantities of those contaminating and hard-to-get-rid-of elements, they ran into trouble. Robert Mushet showed that much of the difficulty could be overcome by adding small amounts of spiegeleisen, which is pig iron containing up to 15-20 percent of manganese.

To make the process amenable to treating pig iron from ores obtained from Belgium and other parts of western Europe that are relatively high in sulphur and phosphorus, Thomas and Gilchrist in 1878 developed a magnesium-and-lime lining for the converter and added lime during the blowing period. That caused the phosphorus to enter the slag as calcium phosphate and resulted in what is known as the basic Bessemer process. When finely ground, this slag is a good fertilizer, so a valuable by-product was obtained. Because of the character of the ores in those areas the Bessemer method still accounts for approximately 50 percent of western Europe's steel production. Over the world as a whole, its proportion is around 5 percent.

Aside from being favored by rail makers, the new steel was immediately in demand for structural forms and spurred the construction of tall buildings. It was likewise quickly adopted by machinery manufacturers because it could be cast readily. As time went on it was also found to machine well and is still considered to be the freest machining steel obtainable.

Alexander Holley, an American engineer, did much to make the Bessemer process practicable in this country. Capt. E. B. Ward, who turned from building ships and operating them on the Great Lakes to making steel, is credited with having first produced Bessemer steel commercially in the United States—at Wyandotte, Mich. Converters now used in America range in capacity from 10 to 25 tons, but in Europe they run to 40 and 45 tons. The Bessemer process was dominant in America until 1908, when the open-hearth method surpassed it. During World War II, Bessemer output temporarily increased to a marked extent as long-idle converters were put back in service.

The Bessemer process is often referred to as pneumatic steelmaking, but actually even our modern steel mills would have to close down if they were deprived of air. It is indispensable in every major melting step, as well as in the foundry cupola. At one time in the remote past, when the air blast was supplied by lung power or by crude bellows, furnaces were built on windy hillsides so that as much as possible of the air blast would be of Nature's making.

To produce a ton of iron in today's blast furnace you need 3¼ tons of solid raw materials and 4½ tons of compressed air. An open-hearth furnace uses 435 pounds of air for each ton of steel it turns out, not including 15 pounds of combustion air for each pound of fuel oil consumed in furnishing heat. To make an average 25-ton converter blow, 32,000 pounds of air is required to oxidize 2135 pounds of carbon, 620 pounds of silicon and 195 pounds of manganese. The turboblowers utilized for this service normally compress from 25,000 to 30,000 cfm of air to 22-28 psi pressure.

The latest idea is to supply oxygen instead of air to blast furnaces and open hearths, and considerable pioneering has been done with generally encouraging results. Air contains only about 23 percent of oxygen, but the remaining 77 percent of it also must be compressed, heated and discharged under conventional methods, thus wasting much heat.

This and That

Natural Air Conditioner

A novel air-conditioning system that raises the temperature of cold air in winter by making ice and uses the ice in summer to reduce the temperature is in operation at the Stobie section of The International Nickel Company's Frood-Stobie Mine in the Sudbury District of Canada. When the thermometer drops below zero during northern Ontario's frigid winters, ice production is stepped up to take the chill off the fresh air entering the workings. The basis of this unusual system is a convenient twist of nature whereby heat is released when ice is formed.

A fan having a diameter of 198 inches and a top capacity of 750,000 cfm—one of the largest in the world—blows fresh air from the surface through a 300-foot vertical airway, 20 feet in diameter, into two huge open stopes mined for this purpose between the 300- and 500-foot levels. Each stope is 80 feet wide, 200 feet long and 200 feet high and the two are separated by a pillar 70 feet wide. The air circulates through the stopes in succession on its way to the main intake.

Water under 120-psi pressure is sprayed into the downflowing air at four points at the top of each stope during the cold months, and as the fine particles turn to ice the heat given up in the process is transferred to the air. Some 40,000 tons of ice was formed at the bottoms of the stopes during the past winter. This heat, along with that absorbed by the air from the large wall area in the stopes, amounted to 15 billion Btu's—the equivalent of burning 100,000 gallons of oil or 850 tons of coal.

Although the surface temperature reached 25° below zero, the fresh air delivered from the main intake of the ventilation system 600 feet below ground varied from 27 to 30° above as a result of its side trip through the ice stopes. Eventually, as the system is improved, the temperature in the workings is expected to be held at about 32° above zero. When the air handled reaches its full volume of 750,000 cfm, as compared with 150,000 to 300,000 cfm during the past season, upwards of 140,000 tons of ice will be formed each winter.

In summer the ice will be melted by the warm fresh air passing through the stopes and the air cooled between 5 and 10°. The humidity of the air also will be reduced as it drops below the dew point and much of its moisture condenses and remains in the stopes. This phase of the Stobie air-conditioning system is similar to that at Inco's Creighton Mine where fresh air is cooled by passing it through a natural refrigeration system in the old workings where seepage water freezes during the winter. At other Inco mines where fresh air is required for heating, steam or oil installations are used.

When the Stobie operation was being planned it was noted that the logical position for the main fresh air intake was near a low-grade section of the ore body located conveniently between the two main mining areas. It was then that the feasibility of establishing ice stopes presented itself. As a result, Stobie has been equipped with a remarkably efficient air-conditioning system at a fraction of the cost of a surface heating plant.

* * *

Shipping Hazard Doomed

Rock drills and dynamite charges will demolish Ripple Rock, a submerged hazard to shipping in Seymour Narrows between Vancouver Island and the British Columbia mainland. The Narrows, with an average width of 2500 feet, is the most constricted part of the Strait of Georgia which opens into the Strait of Juan de Fuca on the south and Queen Charlotte Strait on the north. Located at the southern end of the Narrows and almost in the center is Ripple Rock, a hogbacked mountain, with two pinnacles that are only 9 and 20 feet below mean low water. On one side of the obstruction the water is 400 feet deep and on the other side 325 feet.

Twice daily the tides rush through the narrow passageway at velocities that normally reach 10 knots and at times 15. Since 1875 fourteen large vessels and more than 100 smaller ones have struck bottom and sunk there and 114 lives have been lost. Most ships wait for the slack tides, which last 20 to 40 minutes, to dash through. Turbulence is at a minimum then, but at times whirlpools and high winds drive vessels onto the rocks.

Two unsuccessful attempts have been made to remove the upper parts of the pinnacles by drilling from floating equipment. At the first try cables used for anchoring the barge snapped off repeatedly. A different and better anchoring method was devised for the second effort, but drilling progress was so slow that the work was abandoned as impracticable.

After studying numerous suggestions, the Canadian Government decided to explore the idea of attacking the obstacle from underneath. Boyles Bros. Drilling Company, of Vancouver, was commissioned to bore a 2500-foot curved diamond-drill hole from Maud Island on the east side of the Narrows to a point in the base of Ripple Rock to determine whether rock conditions were favorable to tunneling. This tricky piece of controlled drilling was accomplished after one failure. The hole reached a depth of 1000 feet on a 22° angle, was leveled off to horizontal and finished on an upward slope of 8°.

The recovered core showed that the rock was sound, and the Department of Public Works then prepared plans and specifications for a tunneling project and asked for bids. The job went to Boyles Bros. and the Northern Construction Company & J.W. Stewart Ltd on a bid of $2,639,878. They established a base of operations last November on Quadra Island, which is connected to Maud Island by a causeway.

The plan calls for sinking a shaft 550 feet on Maud Island, driving a 2370-foot tunnel with a minimum of 100 feet of rock cover to a point underneath Ripple Rock, then raising approximately 300 feet and excavating chambers, coyote drifts, etc., in which to lodge dynamite. It is expected that between 750 and 850 tons of explosives will be set off in late 1957 or early 1958 and that it will remove the rock to a level of at least 40 feet below mean low water. Sinking of the shaft has been completed with the aid of six Canadian Ingersoll-Rand JR-38 Jackdrills that can be mounted for tunnel driving and perhaps also used for the final steps of raising and drifting.

* * *

Pneumatic Wood-Waste Collectors

Large woodworking establishments are usually equipped with systems that collect waste chips and sawdust. One that meets all the problems involved in handling such scrap has just been installed at the Federal Equipment Company, Carlisle, Pa., which makes lock boxes, special furniture and other things for the Post Office Department. Heavy waste, sanding dust and wood flour are picked up by suction from operating machines as well as from key floor locations, thus eliminating cleaning. There is no longer a fallback of chips to spoil work, the clean equipment functions more efficiently for longer periods than before and is more productive, working conditions are pleasanter and the fire hazard has been reduced.

The materials picked up are conveyed by pneumatic tubes to a primary collector and filter and thence to a secondary collector and the boiler room, where they end up as fuel. In winter the filtered air is returned to the plant with little loss of heat; in summer it is exhausted to atmosphere. The company reports that fuel costs have dropped 77 percent since the system was put in and that 12,000 square feet has been added to the production area by getting rid of floor litter.

Proof of Smaller World

A straight line 5,777.5 nautical miles long has been surveyed by the U.S. Army Map Service. It runs from a point in Finland to the southern tip of Africa, crossing the Mediterranean Sea en route, and is about twice as long as the previous longest surveyed straight line. Cartographers claim that use of the longer line for reference will improve the accuracy of maps by a factor of four. An early result of the survey is a reduction in the calculated diameter of the earth at the equator from 12,756,520 meters to 12,756,264 meters, or a difference of 256 meters. The reference line will also be of aid in plotting the courses of the first satellites to be placed in an orbit around the earth.

* * *

Suggestion Plans Popular

Suggestions from employes are reported to be gaining in popularity in the automotive industry as a means of off-setting rising costs of materials and labor. Together, General Motors and Ford Motor Company paid out $4.2 million last year for helpful ideas. As the reward usually amounts to about one-sixth of the annual saving it makes possible, it is assumed that the two concerns trimmed their costs by about $25 million by acting on the suggestions. Awards range up to $3000 per idea at GM and $2500 at Ford (Chrysler recently instituted the plan and has a $2500 maximum.) Some workers turn in a suggestion every week and still haven't struck pay dirt, while others, who understandably contribute only occasionally, have never missed.

* * *

Latent Power In Sky

The idea of a "Buck Rogers" space ship came a little closer to reality recently when scientists confirmed that the outer layer of gas surrounding the earth (the ionosphere) may contain enough chemical energy to help power a rocket ship. An Air Force Aerobee rocket shot from Holloman Air Force Base released 20 pounds of compressed nitric-oxide gas into the ionosphere. The liberated gas acted as a catalyst to aid dissociated oxygen atoms to recombine into molecules. The resultant reaction gave off enormous energy in the form of light —a disk seemingly four times the diameter of the moon and about half as brilliant was formed in the night sky over New Mexico. The confirmation of the theory, long held by many engineers and scientists, may mean that previous estimates of the quantity of fuel needed to provide escape velocity from the earth are needlessly high. (Escape velocity is the speed needed to overcome the attraction of the earth's gravitational field.)

* * *

Italians Constructing Superhighway

Italy is building a superhighway that will link Milan and Naples and pass through Bologna, Florence and Rome en route. It is considered to be a major engineering project, with 63 short tunnels and large bridges across eight rivers. The grade will average 3 percent in flat country and 3.75 percent in the mountains. The Apennine Mountains will be crossed at Citerna Pass at an elevation of 2381 feet, which is 820 feet lower than the present road.

The highway will be approximately 79 feet wide over-all, with two paved strips each 24.6 feet wide separated by a central hedge 9.8 feet wide. Along each side will be a paved pathway 8.3 feet wide for cyclists that can also be used for emergency parking of automobiles. Authorized maximum speeds will range from 62 to 100 miles per hour, depending on the section. The estimated cost of construction is $295.4 million. The Italian government will defray 36 percent of the cost and private capital the remainder.

Prehistoric Aqualunger

THE animal illustrated, long extinct, is a Corythosaurus, identified as a member of the Hadrosaur family of dinosaurs. It is of interest to us because it was perhaps the first living creature with a built-in air receiver. The crest or dome on the head was presumably hollow and, so the story goes, enabled the beast to carry a considerable supply of air for breathing while dining on underwater vegetation or submerged in hiding from larger carnivora.

Our picture is of a 5-inch scale model in porcelain—one of a series of dinosaur statuettes sold by Abbeon Supply Company, of Jamaica, N. Y. According to a card that accompanied it, this creature was one of the so-called duck-billed dinosaurs that apparently roamed over a good part of North America during the upper Cretaceous geological period. The crest capping the skull was its distinguishing feature.

The Corythosaurus wasn't one of the biggest dinosaurs. Although it had a mouth full of teeth—some members of the same family had as many as 2000—they were better fitted for masticating vegetable matter than for fighting. For that reason the animal had a hard time surviving and seems to have done so principally because it could hide under water for long periods. Webbed fingers and feet helped it to submerge fast and also to propel it through the water. The hindlegs and tail likewise were well adapted for swimming. The Corythosaurus lived in swamps and was a strict vegetarian. When some of its teeth were worn down far enough to become useless they were conveniently replaced by others.

The card aroused our curiosity, and we decided to check up on the air-receiver theory but failed to find mention of the Corythosaurus in either our dictionary or encyclopedia. Nor did the New York Public Library, usually very helpful, provide us with what we were after. So we went to the most logical fount of knowledge, the New York Museum of Natural History.

Doctor Colbert, curator of the prehistoric reptile section, was familiar with the animal and stated that the explanation of the purpose of the crest that had been given us is purely speculative but nevertheless as good as any. Incidentally, Doctor Colbert said that anyone interested in dinosaurs might profitably follow the Alley Oop strip cartoon that appears in many newspapers. Alley, a prehistoric man who commutes between past and present ages by virtue of Doctor Wonmug's marvelous "time machine," has a pet dinosaur named Dinny back in his native land of Moo. Dinny and others of his ilk often appear in the pictures. They're all authentic, too, according to Doctor Colbert.

It seems the artist, V. T. Hamlin, takes pride in his work and has become something of an authority on the gigantic creatures. Whenever he is in doubt, he pays a visit to the museum and confers with the experts there. Perhaps sometime he'll satisfy our curiosity with an explanation of the Corythosaurus's topknot in his cartoon.

Wrings Fabrics and Bonds Laminates

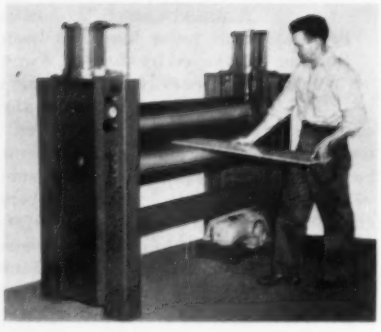
MACHINES designed for a specific purpose are sometimes found to be well adapted for service in unrelated fields. Take, for instance, the Wring-Master pneumatic squeezer which was originally designed by Rodney Hunt Machine Co., of Orange, Mass., for the textile wet-finishing trade and is now doing effective work of an entirely different nature. In modified form as the Wring-Master Rotary Press it is being used in making laminated panels today in great demand for the manufacture of luggage, television and radio cabinets, instrument cases, switchboards, furniture, sink tops and other products.

Of heavy construction, the machine bonds high-pressure plastic laminates, vinyl or linoleum to plywood, metal and other firm backing materials with adhesives such as the newer contact-bond type and also turns out 3-ply panels with honeycombed paper cores. It is equipped with two double- and direct-acting air cylinders that apply pressure to the top or working roll, which is always in vertical alignment regardless of panel thickness. Pressure required to insure a satisfactory bond depends upon the materials and adhesives used, as well as the type of construction, and ranges from as low as 15-25 pounds per lineal inch to prevent crushing the cores of the 3-ply panels to 75-200 pounds per inch for more rigid ones.

In manufacturing panels 48 inches wide, the Wring-Master press, equipped with 8-inch-diameter pneumatic cylinders, can be loaded up to 8000 pounds, which results in a pressure of 175 pounds per lineal inch or 150 psi, as the width of the nip (the line of pressure between the contacting rolls) is approximately $1\frac{3}{16}$ inches. This is more than adequate for most bonding operations. For sizes up to 60 inches, loading can be increased to 10,000 pounds by substituting 9-inch for 8-inch cylinders.

The pressure-roll gap (daylight opening) is adjustable for panel thicknesses up to 5 inches. Once set, the press can be run as an independent unit or as part of an assembly line, the work in the latter case passing through automatically at speeds from 15 to 30 feet per minute. In one plant where laminates of magnesium and vinyl are made for luggage, the metal sheets are sprayed with adhesive in solution distributed evenly by squeegee rolls. This is followed by heating: once, to get rid of the solvent and a second time to raise the temperature of the magnesium to 300°F preparatory to bonding. The plastic is fed cold from 300-yard rolls, and as it has a tendency to spread under the pressure of the Wring-Master is cut slightly narrower than the sheet metal.

When the panel emerges from the press, both the magnesium and the vinyl are of the same width. To keep the latter in perfect alignment on its way to the machine it travels over a tube with perforations spaced $\frac{1}{16}$ inch apart. Should the material deviate from its course and uncover a hole or holes it is automatically brought back into line. It is reported that the product has an exceedingly high bond strength, will withstand continuous temperatures up to 250°F and can be sheared, crimped, bent, drilled and punched with standard tools.



MANUAL OPERATION

Shown here is a Model PB Wring-Master Rotary Press with two 6-inch stroke, double-acting air cylinders that apply pressure to the top or working roll. The machine has a rated loading of 8000 pounds using air at 80 psi line pressure. The rolls are covered with a special-density Neoprene that resists both the cleaning solvents used and the residual heat of the panels coming from an infrared reactivating oven. Operations are controlled by push buttons.

AIR RECEIVERS FOR AIRPLANES

These fiber-glass spheres, shown being packed for shipment, have a capacity of 900 cubic inches and are for pneumatic applications in airplanes. Manufactured by Walter Kidde & Company, Inc., they weigh 16 pounds each, as compared with 25 pounds for equivalent steel vessels. They retain their physical characteristics at the high temperatures found in high-speed aircraft, and the weight savings they make possible are significant when considered in terms of range, payload or firepower.

Improvements in Silk-Screen Printing

SILK-SCREEN printing, which is probably the world's oldest printing process and which has undergone little change since it was first practiced by the Chinese and Japanese, is being modernized like everything else. The name stems from the fact that the design to be reproduced has traditionally been stenciled on silk that is then stretched in a frame. Transfer of the pattern is effected by means of a squeegee which distributes the coloring matter and forces it through the open parts of the stencil or screen onto paper, cloth or other material laid beneath it. In 1955, however, the Germans introduced a fabric woven of stainless steel. Of 180 to 350 mesh (openings) per linear inch, it presents a nearly unbroken surface and is much finer and more uniform than the conventional material. It is used primarily for long runs because of its durability, but it is harder to stretch by hand than silk and costs more. However, the wire screen makes prints that are said to be superior to the best produced on silk ones.

Our interest is mainly centered on a new pneumatic frame and squeegee, which also are of German origin. The rectangular frame is a hollow rubber tube with a metal support over which the silk or wire screen is laid loosely and locked in position. By the older method the silk itself was tightened; now the frame is expanded by introducing compressed air, thus stretching the material until it is of the desired tautness. A bicycle pump will do the trick. The advantage of the new frame is that it insures a screen that remains firm after repeated use, a prerequisite to good work.

Similarly, best results are obtained with a squeegee that is straight and gripped evenly throughout its length. That, it is reported, is not the case with the familiar type—a rubber blade generally inserted in a slot in a solid piece of wood and held in place by screws which cause the squeegee to bulge at the points of contact. The improved holder consists of a hollow rubber tube which, when pumped full of air, grips the blade with equal pressure from one end to the other.

The stainless-steel fabric, the frame and the squeegee are manufactured in Germany and handled in this country by Serascreen Corporation.

Circle 1E on reply card

Industrial Notes

An improved Oyltite Stik for sealing cracks, pinholes, rusty parts in welds and the like in oil pipes, tanks and other containers has been produced by the Lake Chemical Company. It is rubbed on the leaky area while the oil is flowing and is effective, it is claimed, on metal surfaces subjected to pressures and temperatures up to 75 psi and 400°F, respectively.

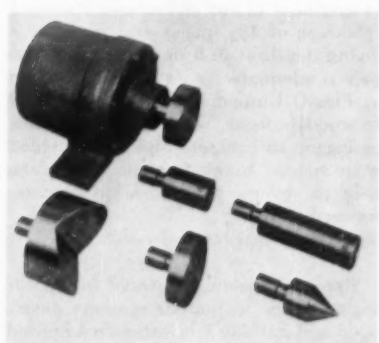
Circle 2E on reply card

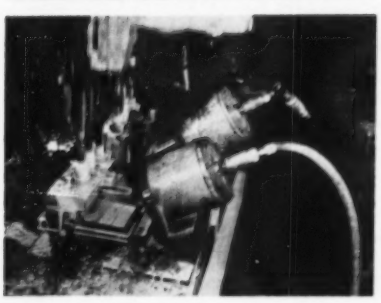
Structoglas is the name of a new shatterproof glazing material that comes in green, blue and clear translucent tones in standard sash sizes. A glass-fiber-reinforced plastic with a pebble-grain surface, it is made by International Molded Plastics, Inc., and is said to reduce glare without interfering with the transmission of light, to serve as an insulator against heat and to minimize breakage and maintenance.

Circle 3E on reply card

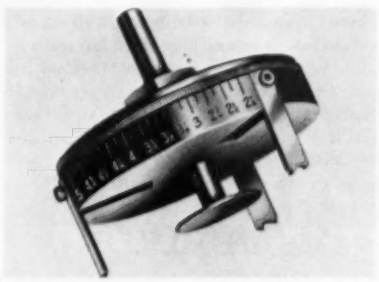
For use in connection with industrial machinery there is now available a universal air fixture lock that is said to insure split-second clamping. As one of the accompanying illustrations shows, it consists of a pneumatic cylinder that is machined to receive five interchangeable holding tools which have ½-inch undercut adapter shanks and can be locked in position with a 3/32-inch socket set key. The cylinder can be installed in any position, shifted from one job to another and comes in three sizes with rated clamping forces from 650 to 2300 psi and power strokes from 1⅞ to 3⅛ inches. Two of the units are pictured mounted on a fixture to lock workpieces in place for a drilling operation. Other applications include moving one part of a fixture against another; pushing work into cutters; automatically loading or ejecting work; pressing parts into workpieces; and moving components of a machine such as a drill-press quill or the tailstock of a lathe. The lock is made by Wilton Tool Mfg. Co., Inc., and can be used with customers' holding tools.

Circle 4E on reply card



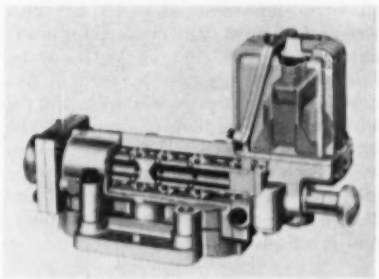


To its line of Dial Saws for cutting large holes of varying sizes in wood, metals or plastics, Robertson & Ruth has added another model that is based on the same principle as the earlier ones but has a greater cutting range. A turn of the calibrated dial sets its high-speed blades for cutting any diameter from 2¼ to 5 inches. Designated as the Model 500, it is available in three types: with ½ or ¾-inch straight shank and with Morse No. 2 taper shank. Each is supplied with a ½-inch pilot drill and push-out plug and with two sets of blades for wood and metal cutting to depths of 1½ and 1¼ inches, respectively.



Circle 5E on reply card

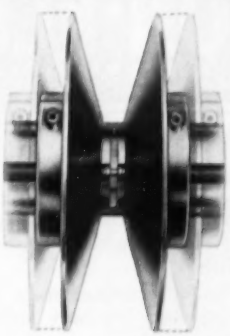
After three years of development and testing, C.B. Hunt & Son, Inc., has announced an air and hydraulic control valve that is said to offer a number of novel features. Designated as the B-Type, it has a short stroke solenoid that moves the plunger of a small normally open pilot valve, thus shutting off the air supply, exhausting the operating piston and permitting the bucking cylinder to move the main-valve plunger toward the solenoid, which is cushioned both top and bottom. When the latter is deënergized the valve shifts back to the original position. Low amperage requirement of the solenoid eliminates intermediate relays



SINGLE-SOLENOID VALVE

The valve chambers are formed by use of aluminum spacers, a patented arrangement that permits supporting "O" rings or "U" packers on the inside and outside diameters and conversion from one to the other. Piping is connected to the subbase mounting and does not have to be disconnected when the valve is removed for inspection or repair.

only a twist of the wrist



for the right speed setting

Wood's offers the simplest variable speed sheave on the market today! So easy to change speeds. Simply turn the single adjusting screw from either side to change pitch diameter. With the speed chart furnished you can adjust the sheave to the desired speed without trial and error. Simplified design provides positive clamping of the two adjustable flanges . . . eliminates fretting corrosion. Single wide range belt gives maximum HP efficiency. Does away with the problem of maintaining matched belts and matched grooves.

Write for Bulletin #497.

Wood's

T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PA.

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Circle 17A on reply card

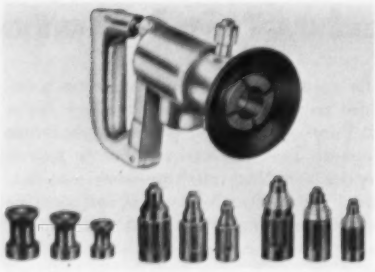
and simplifies electrical control circuits. The solenoid valve is conservatively rated at 600 cycles per minute for continuous operation on air at 40-150 psi pressure and at much higher speeds for intermittent duty at 80-100 psi. Valves of the exterior feed type can be used in hydraulic service at pressures up to 250 psi with air as the pilot medium; of the interior feed type on oil from 40-150 psi at somewhat lower cycling speeds. Single- and double-solenoid valves of the B-Type are available, as well as pilot- and lever-operated designs.

Circle 6E on reply card

So as to conform to the wrapping of the main body of an underground pipe line, the L.O.F. Glass Fibers Company is now offering its Duratape with both sides coated with either asphalt or tar. A glass-fiber bonded mat, the tape is intended for field use in wrapping joints and fittings.

Circle 7E on reply card

Fast and effective cleaning of condenser tubes is now possible, it is claimed, by a handy gun-and-slug method announced by Crane Packing Company. The gun weighs only 2¾ pounds and is operated either by air or water pressure ranging from 50 to 500 psi. One man can quickly load an entire bank with slugs and shoot them through in rapid succession to remove slime and scale.



GUN AND SLUGS

From left to right: spool-type slugs for removal of thin film of slime; bullet-shaped slugs for heavier deposits; and scraper slugs for cutting away scale and mineral deposits. Interchangeable nozzles for air or water operation are not shown.

Three types are available to fit all standard tubes: a spool-like slug for normal slime removal with a cup at the forward end that expands and wipes the surfaces; one of bullet shape for thicker layers; and a scraper type for scale and mineral deposits. The two latter have jet-action holes in the side walls to admit water or air for flushing out the deposits.

Circle 8E on reply card

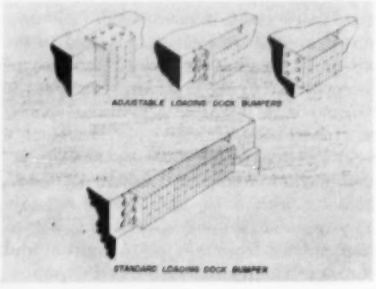
For transmitting pneumatic signals between instruments, measuring devices and control units, Bailey Meter Company has introduced a protective cable called Armortube that houses bundles of four, eight or twelve ¼-inch (O.D.) aluminum-alloy or copper tubing. Other sizes are made to order. The metal cable is of the flexible type and the tubes are arranged ropelike to prevent them from collapsing at sharp bends.

Circle 9E on reply card

Dry graphite packaged for easy application in a hand spray container has been put on the market by The Servwell Products Company. Squeezing a rubber bulb on top dispenses either a light or a heavy spray, depending on the pressure and the distance between the nozzle and the point to be lubricated. Known as the Blaco Graphite Gun, it is handy for domestic and industrial uses. It is claimed that the lubricant does not freeze, melt or dry out.

Circle 10E on reply card

Loading-dock and truck damage, aside from possible cargo damage, can be minimized, it is claimed, by use of a new type of bumper constructed of a rubber-coated fabric that remains resilient even when frozen. A product of Bumpers, Inc., four sizes are available in lengths of 14 and 36 inches, a standard thickness of 4½ inches and to cover a facing depth of 6, 9 or 12 inches. One pair is adequate for any dock. Known as Flex-O Bumpers, they can be bolted to wooden docks, welded to steel plates or lagged to concrete and are provided with special brackets that permit the user to reverse the fabric to increase its service life.



Circle 11E on reply card

Boral, a shielding material for speeding neutrons in nuclear reactors developed and initially fabricated on a limited scale by the Atomic Energy Commission, is now being produced commercially by the Aluminum Company of America in large plates and sheets 0.125 and 0.250 inch thick. The latter is said to have the shielding power of a concrete slab a hundred times as thick.

Circle 12E on reply card

Dual mixing chambers are a feature of a new concrete placer announced by True Gun-All Equipment Company. While one is in service the other is loaded

NON-FLUID OIL

TRADE MARK REGISTERED

FIRST AID FOR AIR TOOLS

If your pneumatic tools do not function properly, due to improper oiling or abuse and carelessness, you can save money and future headaches by having them relubricated with NON-FLUID OIL "NR" OILS.

And to avoid a recurrence, make it a rule to lubricate all your air driven equipment regularly with NON-FLUID "NR" OILS.

These lubricants absorb airborne moisture, forming an emulsion that has even greater lubricating value than ordinary oils. Furthermore, "NR" oils have an affinity for metal surfaces . . . they don't fog and blow out of the exhaust like common lubricants.

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Circle 18A on reply card

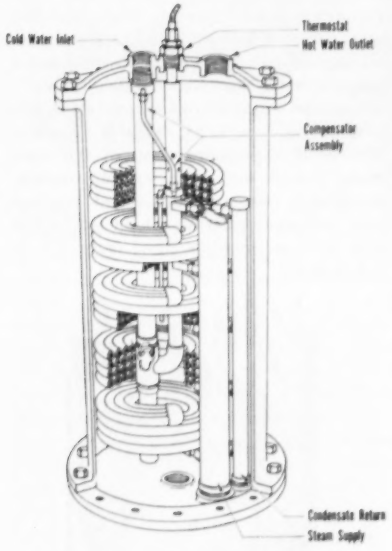
with controlled amounts of aggregate, cement and water, permitting work to go on uninterruptedly. Flow is switched quickly from one to the other by a Siamese valve. The batch is blown through a hose with air at 125 psi, and air is sometimes introduced at the nozzle to promote adhesion.

Circle 13E on reply card

Hot water is a commodity that is on tap most everywhere in small or large quantities and for that reason any new means of supplying it is of general interest. One that is said to effect economies has been developed after years of research by Aerco Corporation. Its hot-water generator is now in production and has been installed in many places including hospitals, laundries, apartment houses, industrial plants, and naval vessels, to list a few. A compact unit, it requires no storage tank, which is of advantage where large quantities of hot water are required. It consists essentially of steam coils, a riser and a compensator assembly all housed in a shell with top and bottom covers for accessibility. The shell is filled with cold water, which enters at the top, flows through the cold-water feed pipe of the compensator assembly into the bottom, and then up past the heating coils and out at the top at the desired temperature. Steam is introduced at the bottom and passes upward through the vertical riser and then through the coils, the number depending upon the capacity of the generator. A temperature regulator in the thermostat tube of the compensator shuts off the steam at the predetermined setting and admits it again as needed to supply water at constant temperature. Aerco heat exchangers with from 5 to 300 square feet of heating surface and from 2.5 to 438 gpm capacity are available for a wide range of services.

Circle 14E on reply card

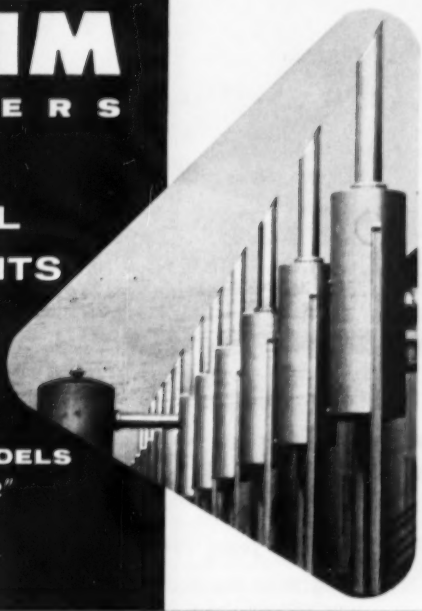
Among the new products announced by C. A. Norgren Company is the Micro-Fog which automatically creates a finely divided air-borne fog that can be distributed uniformly through complex piping systems to numerous points. Though



FIVE-COIL GENERATOR

Each of the tubular units consists of four free-floating concentric helical coils. Steam enters the two middle tubes (Nos. 1 and 2) of the bottom tier, flows spirally to the upper one and then from tube 1 to tube 4 and from tube 2 to tube 3, so on down to the lowermost tier and the condensate return pipe. Rupture of the tube and header connections during extreme temperature changes is prevented by allowing ample room for expansion and contraction.

MAXIM
SILENCERS
FOR ALL INDUSTRIAL REQUIREMENTS



35 STANDARD MODELS
in sizes to fit 1" to 72" exhaust connections

Maxim makes the most complete line of silencing equipment available to industry. That means many "special requirements" can be solved with one of Maxim's "standard" units. If your problem is truly "special", Maxim's longer experience will help you get the answer more quickly and efficiently. Either way it always pays to consult Maxim first.

SILENCERS FOR:

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- VACUUM PUMP DISCHARGES
- BLOWER INTAKES AND DISCHARGES
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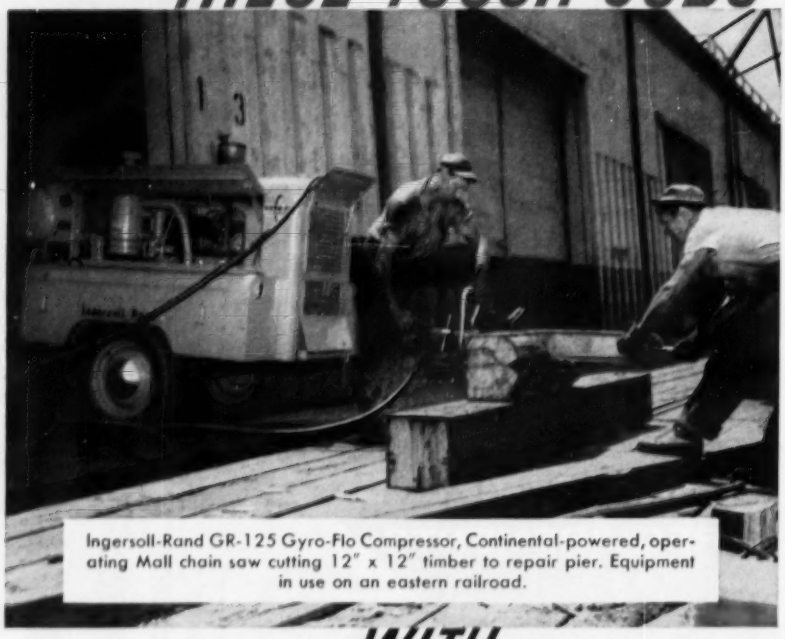
SPEED UP THESE TOUGH JOBS



Ingersoll-Rand GR-125 Gyro-Flo Compressor, Continental-powered, operating Mall chain saw cutting 12" x 12" timber to repair pier. Equipment in use on an eastern railroad.

WITH CONTINENTAL RED SEAL POWER

Year after year, ever since 1902, Continental engines have been proving their dependability in a steadily-lengthening list of special-purpose machines. Today, no matter what the exact requirement of the job, there's a Red Seal model—gasoline, Diesel, or LPG—engineered and built to meet it down to the last detail—a model with the proper performance characteristics, profile, shape and weight. In the industrial line there are models at closely-spaced levels—from 14 to 240 horsepower. You find them on an almost endless number of operations, speeding the tough jobs and delivering their full work quota, day in and day out, with a minimum of time out for adjustment or repairs.

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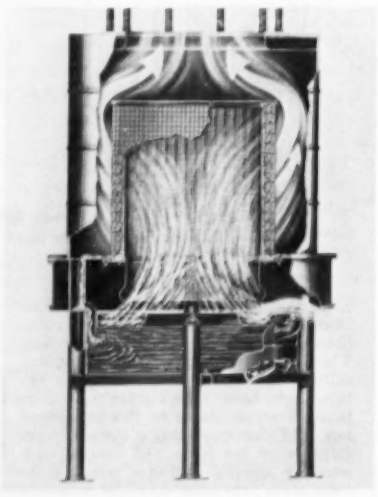
Circle 20A on reply card

measuring only 12x11x9 inches, a single unit can, it is claimed, lubricate even the largest machine—up to 1000 bearing inches—and thus eliminate multiple smaller installations involving many checking and maintenance operations. The apparatus contains all the necessary controls and a 2-gallon oil reservoir adequate for the needs of a 12-hour day at maximum output. Two pressure switches and a float-controlled switch are provided for control-panel connection, if desired, to actuate an automatic alarm system when air-pressure fails, when excessive pressure develops in the reservoir and when the oil supply is low.

Circle 15E on reply card

High efficiency with low pressure loss are claims made for a new oil-bath air filter announced by Air-Maze Corporation. The unit operates without moving parts and an outside source of energy, thus increasing the range of compressors, blowers and engines that can now avail themselves of economical filtration. This is brought about by reversing the conventional oil and air circuit: the air is drawn in under a low-set weather hood and is directed through a regulator tube to an oil-control pan where it picks up droplets of oil that are carried up through a diffusor cone where the air and oil are thoroughly mixed and the air is scrubbed. The latter then goes through a cylindrical filtration element where dirt particles and oil droplets are removed and flow through pipes to a sump where the dirt settles out. Clean oil is metered into the oil-control pan through calibrated holes in the sides of the pan. Models for variable-speed engines and compressors are available in a capacity range of 800-3500 cfm with a pressure drop of 0.6 inch water gauge, minimum, and 4.8 inches, maximum; for constant-speed engines and compressors from 16,500 to 24,000 cfm with a pressure drop from 1.9 to 3.5 inches.



Circle 16E on reply card

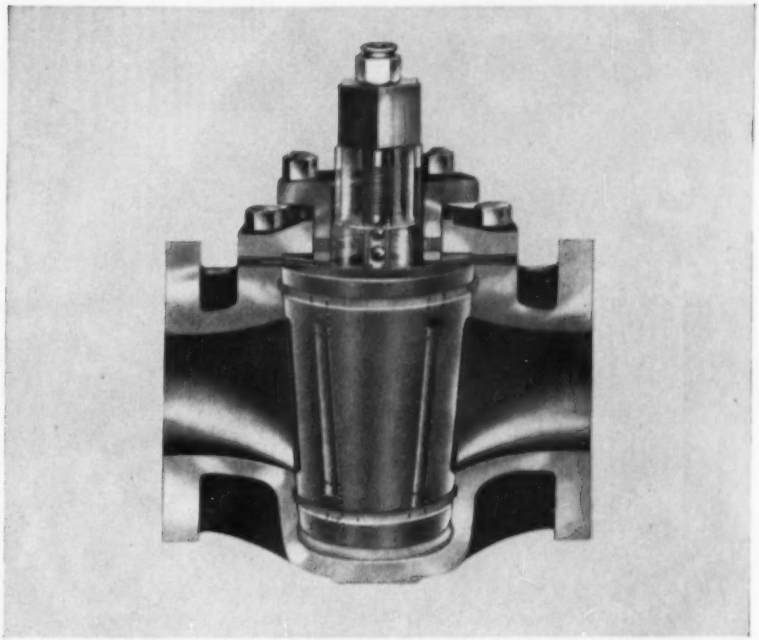
A rolling mill at Trentwood, Wash., will soon be producing sheets of aluminum in shades of gold ranging from pale straw to deep bronze and in either bright or satin finish. The process, which is patented, was developed by Kaiser Aluminum & Chemical Corporation and uses no dyes. Instead, readily alloyed constituents are added to the aluminum when in the molten state. The resultant metal is the same color as normal aluminum but turns gold when anodized. Tests equivalent to seven years of exposure to the sun indicate that the color is permanent.

For looping, bending, forming, coiling and pressing operations in the manufacture of springs, The Carlson Company has designed a high-speed air press as a replacement for slow-moving kick

presses. Of the bench-mounted type, it comes ready for service with bolster plate, foot switch, solenoid valves, electrical fittings and air-line connections. Ram stroke can be adjusted up to 2 inches by a screw stop, and speed is controlled by a valve on the air line. With air at 70 psi it exerts a pressure of 1375 pounds, and with 100 psi, 1 ton. It is reported that the machine has made more than 1800 loops and 3000 punches per hour. It can also be used in other industries for light punching, trimming, cutting and crimping.

Circle 17E on reply card

Shown in the accompanying illustration are two types of a 2-way air valve designed especially by Benjamin Electric Mfg. Company for use in connection with high-speed automated equipment. Operated directly from any compressed-air line at accurately timed intervals in the working cycle, the device serves to eject stampings from punch and kick presses or to produce a powerful blast to remove chips, dust and shavings in



ROCKWELL-
Nordstrom **VALVES**
CUT COSTS
on any
corrosive service

Corrosion resisting metals *plus* lubricant protection make Rockwell-Nordstrom lubricated plug valves a better investment than any other valve you've ever used on processing lines or equipment. Available in semi-steel, steel, stainless steel, Ni-Resist, bronze and Monel, Rockwell-Nordstrom valves assure trouble-free dependability on even the most corrosive service. They cost no more to buy, often less, than ordinary valves—and they continue to save money year after year because:

PRESSURIZED LUBRICANT SEALING eliminates the uncertainties of metal-to-metal seating. Thin, tough film of pressurized lubricant holds lightest gases or heavy slurries.

SEAT IS NEVER EXPOSED to corrosive-erosive line material . . . cuts reseating costs.

LESS DOWN TIME because galled or jammed valves are eliminated. Powerful cushion of pressurized lubricant seats plug for quarter-turn operation.

No matter where you use Rockwell-Nordstrom valves they will save you money. Write for more details. Rockwell Manufacturing Co., Pittsburgh 8, Pa.

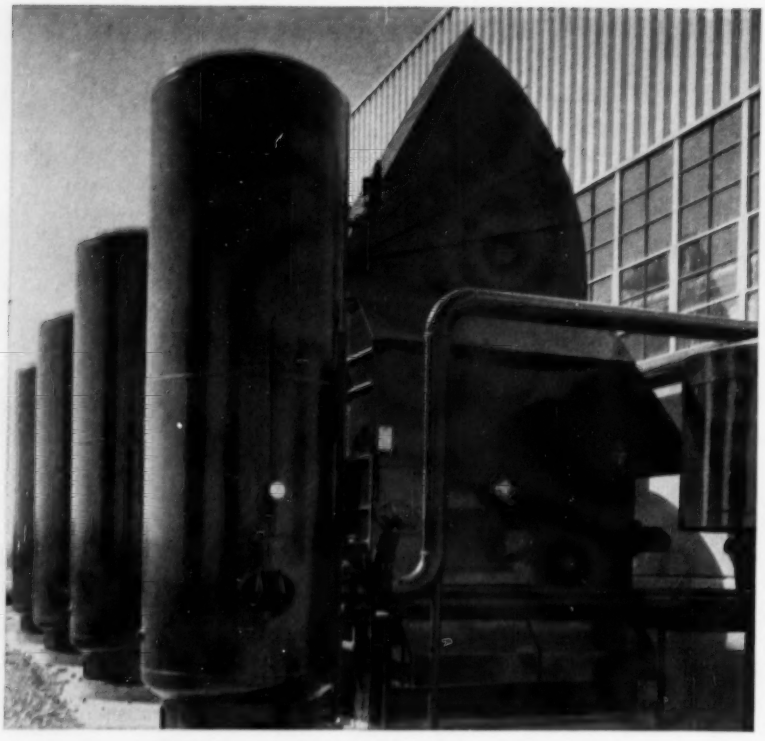
Canadian Valve Licensee: Peacock Brothers Limited.

Rockwell-Nordstrom Valves

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

40th YEAR *of lubricated plug valve leadership*

Circle 21A on reply card



HOW YOU SAVE,
Getting Drier Compressed Air

● Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for complete information; ask for Bulletin No. 130

NIAGARA BLOWER COMPANY

Dept. CA., 405 Lexington Ave. New York 17, N. Y.

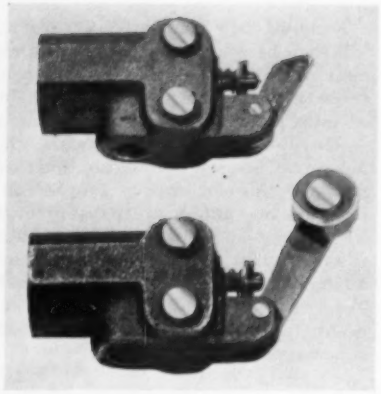
Niagara District Engineers in Principal Cities of U. S. and Canada

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

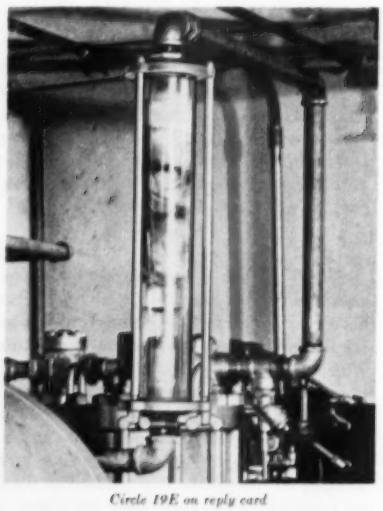
Circle 22A on reply card



drill-press, plastic-molding, cold-heading and machining operations. Made of solid cast brass with hardened steel parts, the valve has flat sides to facilitate installation on any machine surface or to assemble a number of them in a row to deliver multiple air blasts.

Circle 19E on reply card

Cast acrylic-plastic tubing is featured in a new Sta-Dri oil and moisture separator made by Beach Precision Parts Company for compressed-air lines. The purpose of the transparent cylinder is to enable users to see when the filter elements are saturated and need replacement and the trapped water should be drained. The tubing, manufactured by the Cadillac Plastic & Chemical Company, has a wall thickness of 3/8 inch and is said to be unaffected by common chemicals and to withstand up to 150 psi air pressure. The clear-view separator is recommended for applications calling for clean, dry air such as is required for breathing, agitating liquids, in the chemical and food processing industries, for pneumatic tools, electric control valves, laboratory instruments, etc. The installation shown is in the plant of the Ethylene Chemical Corporation.



Circle 19E on reply card

BRIEFS

To transport milk from high-altitude fields to lower cheese-making plants Swiss dairymen are using 4 miles of plastic pipe.

•

How to get a municipal swimming pool: Five years ago Valdosta, Fla., donated a 275-acre tract on which National Container Corporation erected a $25-million paper mill. This year the company's president gave the Valdosta Youth Center a $35,000 pool.

•

The University of Minnesota will present its sixth annual drilling symposium on the school's Minneapolis campus October 11-13. Papers and discussion will be on the subjects of production drilling and blasting.

•

A plastic blowgun made by A. Schrader's Son, of Brooklyn, N.Y., is sparkproof and therefore safe for use in arsenals, chemical plants and other places where electricity presents a hazard. The gun's light weight is an advantage where used frequently.

•

Collaborating metallurgists from New Jersey Zinc Company and Armour Research Foundation have developed a brass powder that promises to be suitable for making intricate parts by the powder-metallurgy technique. After testing more than 100 alloy combinations they found one that possesses the hardness they were seeking.

•

A Rochester, N.Y., man has invented a shower bath and locker-room shoe with no uppers, straps or anything else but soles. In the upper face of each sole are thirteen holes that extend partway through. When stepped on, the holes become vacuum cups, and the sole adheres to the foot. To remove it, the wearer opens a flap in one side of the sole, admitting air and breaking the vacuum.

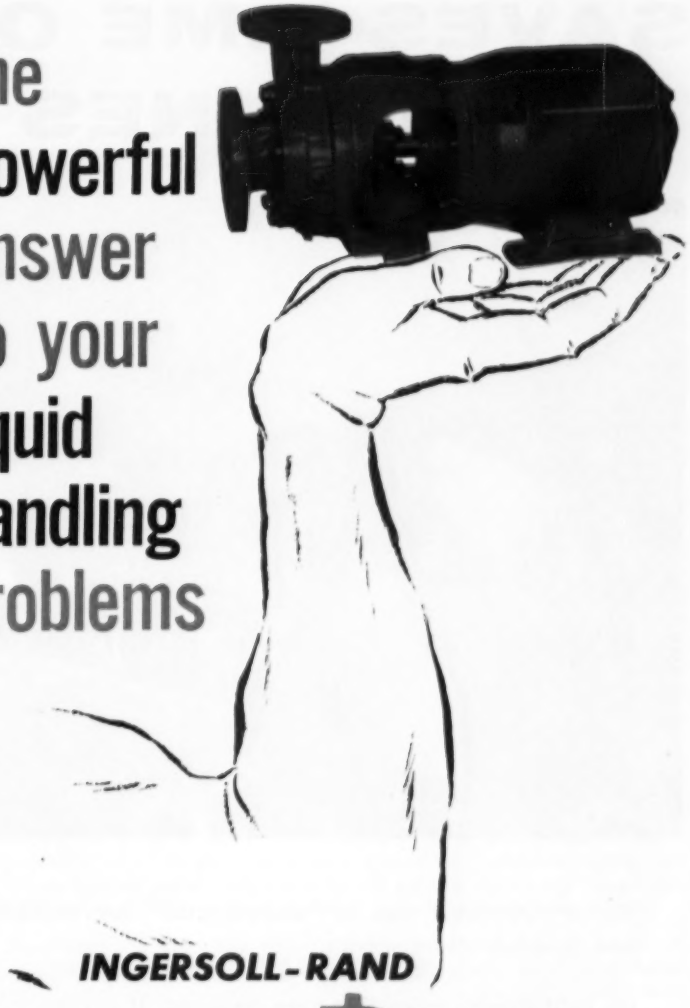
•

Throw-away clothes may soon be the thing for workers. Kimberly-Clark Corporation, Neenah, Wis., is testing paper coveralls, restaurant aprons, hospital gowns and other garments that get so soiled that they are hard to keep clean by laundering.

•

For the aged or sick an elevator in a house is a great convenience. Now, we are told, a portable carrier can be installed in a home in an hour without damaging any part of it. The lift consists of a 12-inch wide aluminum track that rests on the edge of the steps, and of a chair in which all electrical and operating mechanisms are enclosed. It is push-button controlled by the rider and stops automatically at the top and bottom of the stairway.

the powerful answer to your liquid handling problems



INGERSOLL-RAND

MOTORPUMP

When production lags because of inadequate pumping facilities, you need the dependable power of an Ingersoll-Rand Motorpump. These pumps are designed for deliveries of from 5 to 2800 gallons per minute, they operate in any position and being compact, save floor space as well!

I-R Motorpumps are efficiently designed for economical performance and ruggedly constructed to stay on the job with a minimum of maintenance.

To get all the details on I-R Motorpumps in sizes from ¼ to 75 hp, write for complete catalog data.

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

Circle 23A on reply card

SAVES TIME ON VENT LINES

Naylor Spiralweld pipe is "made-to-order" for ventilating jobs in construction service.

Its light-weight makes for easy handling. It saves time on installation . . . especially with the one-piece Naylor Wedge-Lock coupling which can be joined with only a hammer. Lines hug the wall . . . can be assembled with only one side of the pipe in the open . . . and extended readily as work progresses.

You save money, too, because the greater collapse strength inherent in the Naylor structure permits the use of lighter gauge material without sacrifice of performance.

Write for the complete story. Ask for Bulletins No. 507 and No. 514.

NAYLOR PIPE

Naylor Pipe Company • 1245 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Circle 24A on reply card

Books and Industrial Literature

Techniques of Plant Maintenance and Engineering 1956 is a report on the conference held concurrently with the Plant Maintenance and Engineering Show. It contains the texts of sixteen papers, summaries of fifteen round-table discussions and answers to about 1100 specific questions relating to the subject. The book is the seventh in the series and has 248 pages including 110 illustrations, tables and charts. Five industries receive special attention: air-transport shops, chemical plants, petroleum refineries, paper mills and paper-product plants and textile mills. Papers and discussions cover a variety of subjects from preventive maintenance to report writing, use of punched-card tabulating equipment, tool-room control, etc. It is available from Clapp & Poliak, Inc., producers of the show and conference, 341 Madison Avenue, New York 17, N.Y. Price $10.00.

Antioxidants for Greases is the title of a report written by S.F. Calhoun of the Rock Island Arsenal Laboratory, U.S. Army, following a research program conducted by the Army Ordnance Corps. Forty-five compounds were tested in greases at 210°F, and those that were effective at that temperature were tested at 250°. Only six of them inhibited oxidation for 500 or more hours at the latter degree. According to the findings, amines are better inhibitors of oxidation in greases than any of the others studied, with phenylenediamines the most outstanding of the group. The 34-page report, PB 121017, may be ordered from the Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. Price, $1.00.

Facts about Ancor-Flame sponge-iron powder used in cutting, scarfing, gouging, lancing and washing processes are contained in Bulletin 1051 announced by Hoeganaes Sponge Iron Corporation.

Circle 20E on reply card

Characteristics and applications of Losorb, a new additive for moisture-proofing mortar, plaster, stucco and concrete in all forms, are discussed in a bulletin distributed by Pennsylvania Industrial Chemical Corp.

Circle 21E on reply card

Bulletin No. 110 offered by Le-Hi Division of Hose Accessories Company describes and illustrates its complete line of air-hose fittings for mining, quarrying, tunneling, construction and industrial operations. Sizes and part numbers are listed.

Circle 22E on reply card

Information on air-meters, vacuum gauges, manometer-flowmeters and electronic standard cells manufactured by Hastings-Raydist, Inc., formerly Hastings Instrument Company, Inc., is contained in a folder, including price list, obtainable upon request.

Circle 23E on reply card

Bulletin B-1020-5 offered by Conoflow Corporation deals with its pneumatic spring and diaphragm Conomotors of the B-10 and B-20 Series. Typical combinations of these operators with butterfly, adjustable-port and burner valves are illustrated.

Circle 24E on reply card

Ingersoll-Rand Company is distributing a bulletin, Form 7223-B, descriptive of its full line of Class CRV cradle-mounted centrifugal pumps ranging in capacity from 5 to 2800 gpm and pressure from 10 to 525 feet, total head. Typical installation views of the different models are shown, together with

a cross-sectional view that points out the design features common to the line. Also included are performance tables and a tabulation of pump types with their ratings and applications that will help a user to select the unit that will best serve his needs.

Circle 25E on reply card

A 12-page attractively arranged pamphlet called *A Neoprene Sample Case* has been prepared by Du Pont for the automotive engineer and gives him many examples of the material at work in that field. Technical data are not presented because the booklet is not intended for designers. A copy can be obtained by writing to the Elastomers Division, E.I. du Pont de Nemours & Company, Wilmington 98, Del.

A 3000-pound-capacity Cargo-Scout fork truck, the second in the series built by The Elwell-Parker Electric Company, has been announced in an illustrated folder that shows both product and application views, plus engineering drawings. The vehicle features a short wheel base and fifth-wheel steering to permit maneuvering in narrow aisles and inside truck trailers.

Circle 26E on reply card

The new edition of DeVilbiss Company's maintenance painting catalogue, including its new spray-painting equipment for both the maintenance and contract painter, is ready for distribution. Each item is described and illustrated, and an easy-to-read chart specifies the correct gun to be used for each of the varied materials handled. A copy can be obtained by writing to the company at 300 Phillips Avenue, Toledo 1, Ohio.

A comprehensive, well-illustrated bulletin —No. 700—on the Orthoflow, an electrical system for the transmission of metering data from one point to another, has been prepared by Simplex Valve & Meter Company. The system is designed for installation where flow, liquid-level or pressure data must be transmitted quickly and accurately over distances and where the information cannot be obtained through mechanical measuring devices.

Circle 27E on reply card

A brochure describing a new development in valves by Fairbanks Company is just off the press. A renewable seat-ring gate valve, it is said to be the first that permits replacing seat rings in seven to ten minutes under all normal conditions with just a screw driver. Rings are changed without removing valve body from the line. The operating procedure is shown in a complete series of pictures.

Circle 28E on reply card

Two types of universal cylinder mountings that are designed to eliminate problems attributable to misalignment between cylinders and their loads have been developed by Hanna Engineering Works for operating hopper gates, elements rotating about shafts and for objects moving on wheels or tracks. Both are described and illustrated in Bulletin No. 76 obtainable upon request.

Circle 29E on reply card

Reynolds Metals Company has announced that it is increasing the circulation of its *Aluminum Digest* to include the entire metalworking industry. An illustrated 32-36 page monthly publication, it contains reviews of current articles on aluminum that have appeared in some 300 technical periodicals, statistics, patent listings and news summaries of related events. It will be sent free of charge upon written request addressed to Desk ES, Reynolds Metals Company, 2500 S. Third Street, Louisville 1, Ky.

Yes! and here's how...

Is compressed air-line condensate causing you to lose valuable production time? Do numerous blow-downs add to the cost of operating your compressed air system? Do you have a heavy air-tool maintenance load?

These headaches are common when a compressed air system needs an Adams Aftercooler and Cyclone Separator . . . where your compressor discharges directly into the receiver. With Adams units, your compressor discharges hot, vapor-laden air into the Aftercooler. Here the air temperature is reduced to within 10° F of the cooling water. As a result, excess water and oil vapors are condensed.

The Cyclone Separator removes virtually all condensate from the air as it flows from the Aftercooler. That's because the Adams design achieves a high separating factor — even over wide ranges of flow.

Compressed Air, conditioned by this Adams team — Pipe Line Aftercooler and Cyclone Separator — normally enters the distribution system below the ambient temperature. Thus, there can be no further condensation to cause you trouble.

For Twenty Years the Adams team has given thousands of customers dependable, trouble-free compressed air. So, if your plant has problems due to condensate in your air lines, there's a simple answer. Write for our Bulletin 711 and see for yourself.

R. P. ADAMS CO., INC.

209 East Park Drive • Buffalo 17, New York

R. P. ADAMS COMPANY, INC. UA-56
209 East Park Drive, Buffalo 17, N. Y.

We have a compressed air condensate problem. Please have your local representative call on us.

Name..... Title.....

Firm.....

Street.....

City..... State.....

Circle 25A on rep'y card

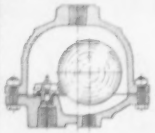
PROTECT COMPRESSED AIR TOOLS

Your Guide to Correct Air Trap Selection

For automatic draining of water from compressed air or gas systems.

Line Drips—

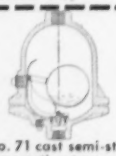
No. 21 direct acting ball float trap is recommended for most installations. Direct acting ... most commonly used trap.



No. 21 cast semi-steel Air Trap

Air Line Separators—

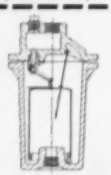
If free from oil or sludge, use No. 71 snap-action trap. Spring-loaded valve snaps wide open and shuts tight. This action is particularly desirable when liquid load is light. Grit will not lodge between valve and seat.



No. 71 cast semi-steel snap-action trap.

Intercoolers, Aftercoolers, and Large Receivers—

Usually contain heavy oil or sludge that fouls up any ball float trap. Use No. 213 inverted bucket trap with a scrubbing wire to provide positive drainage and freedom from maintenance.



No. 213 inverted bucket trap with scrubbing wire. Also forged steel models for pressures above 250 lbs.

Ask for free Bulletin No. 2022 . . . see your local Armstrong Representative or write: Armstrong Machine Works 885 Maple St., Three Rivers, Mich.

Satisfaction Guaranteed

ARMSTRONG AIR TRAPS

Circle 26A on reply card

PROOF OF PERFORMANCE...

BEARIUM METAL is superior to any other bearing material. This statement can be substantiated by "proof of performance" reports from scores of satisfied users.

BEARIUM METAL demonstrates its superiority most quickly wherever there is a bearing application involving high speeds, poor lubrication, excessive loads, elevated temperatures, dusty and gritty surroundings —or where a liquid other than oil must be used as a lubricant.

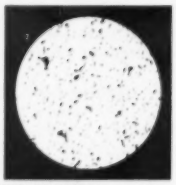
Yes, BEARIUM METAL *does* outperform all other types of bearing materials . . . on *all* counts! Try it on one of your toughest applications and prove it to your own satisfaction.

FEATURES: Non-Seizing and Non-Scoring. Long-Wearing • Self-Lubricating • Low Coefficient of Friction • High Compressive Strength • Resistant to Shock Loads • Sound, Uniform Structure • Free-Cutting.

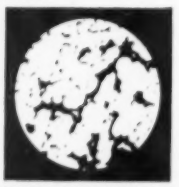
Complete Information on Request.

BEARIUM METALS CORP.
270 State St., Rochester 14, N. Y.

WEST COAST AFFILIATE:
Nevin Engineering Associates
932 Chautauqua Blvd. Pacific Palisades, Calif.
IN CANADA:
Bearium Metals of Canada, Ltd.
155 George St. Toronto 2, Canada

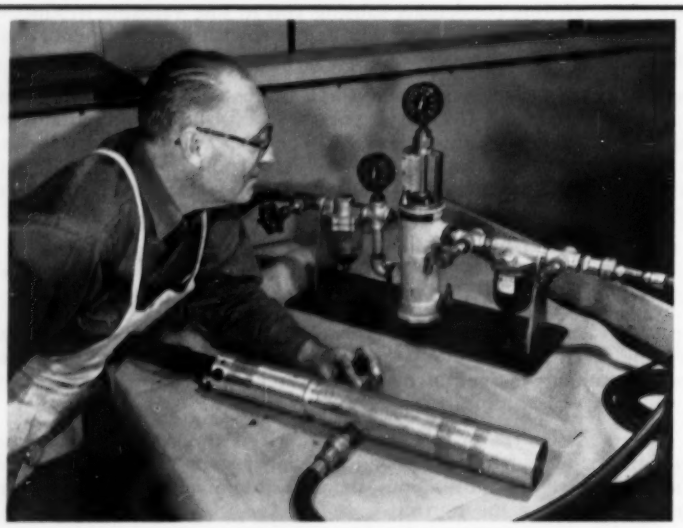


BEARIUM METAL *magnified 25 diameters shows lead (black) in microscopic, globular form, uniformly distributed.*



ORDINARY LEADED BRONZE *at 25 diameters shows poor lead distribution, with lead between copper grains.*

Circle 27A on reply card



YOU TOO can maintain Air Tools and other air using equipment in effective operating condition by using the TOOL-OM-ETER to show excessive air consumption, indicating the necessity for adjustment or repairs.

For further information write for Bulletin A-8.

NEW JERSEY METER CO.

"Specialists in Compressed Air Devices"

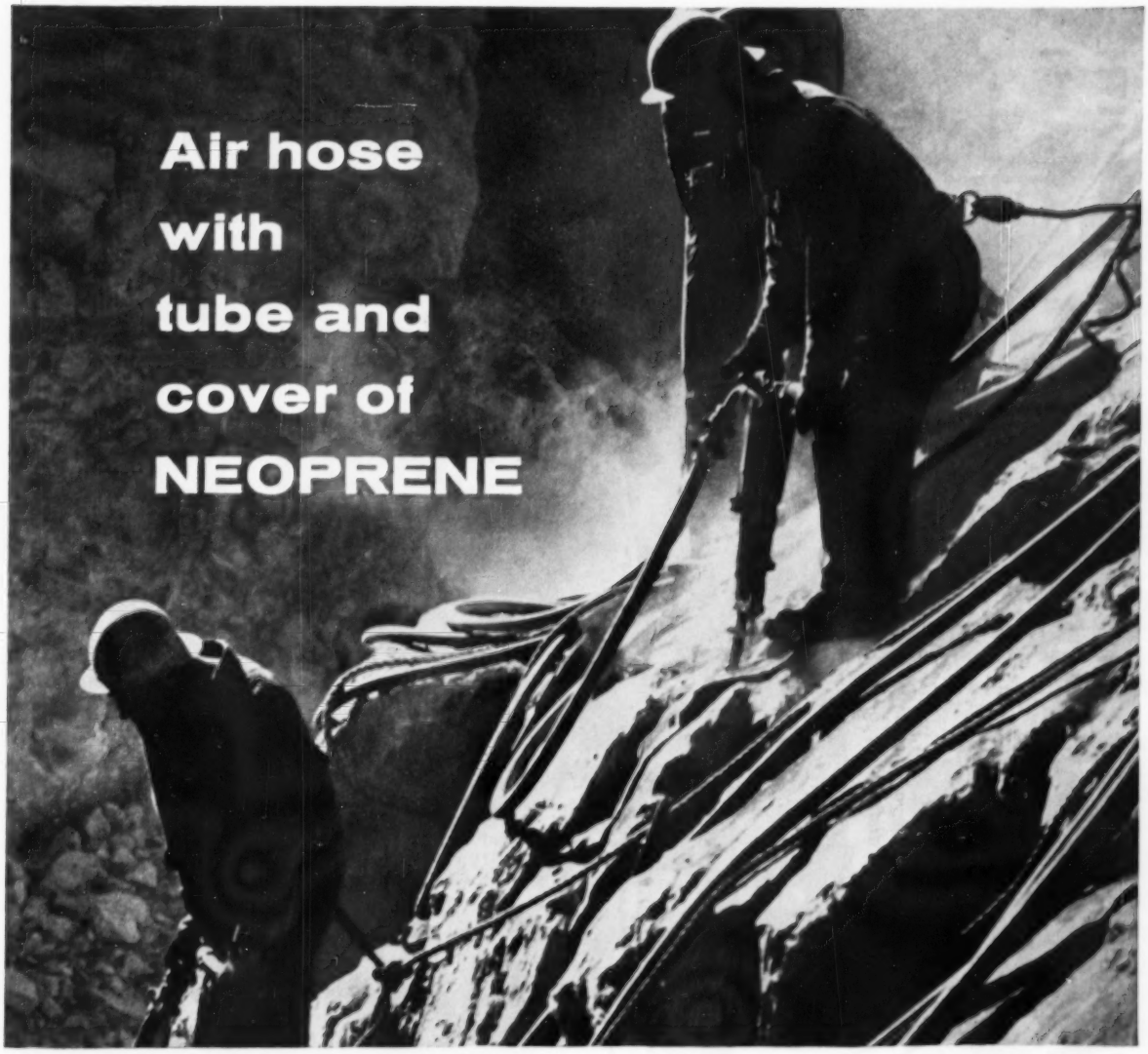
PLAINFIELD, NEW JERSEY

NORTH AMERICAN AVIATION, INC.

Photograph shows Inspector D. L. Underwood, of North American using a 1" TOOL-OM-ETER to check Air Tool for proper air flow.

YOU TOO CAN "Keep your Air pressure UP and your Air cost DOWN".

Circle 28A on reply card



Blistering heat, jagged rocks—but still this hose gives long service!

It takes more than rugged outdoor service to damage air hose made with Du Pont neoprene. This hose thrives on the tough jobs—it's protected inside and out.

Rugged neoprene hose tubes are flexible, resist the attack of hot lubricating oil in the air stream. No tube particles crumble off to clog tool parts.

Covers of neoprene protect the fabric of the hose when it is dragged and twisted over sharp and abrasive objects. The neoprene covers give lasting protection because neoprene resists the deteriorating effects of oil and grease, sunlight and weather.

This double-duty protection, inside and out, is the reason why neoprene cover and tube is used on most compressed air hose. The next time you order hose be sure to specify Du Pont neoprene.

FREE! The Neoprene Notebook
Each issue brings you new, unusual applications of neoprene . . . new products . . . interesting articles. Send in this coupon.

NEOPRENE
The rubber made by Du Pont since 1932

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Elastomers Division CA-8,
Wilmington 98, Delaware

Name _____ *Position* _____

Firm _____

Address _____

City _____ *State* _____

Circle 29A on reply card

FASCINATING! HOSE COMES TO LIFE WITH PUNCH-LOK HOSE CLAMPS!

"The sign of a GOOD Hose Clamp"

PUNCH-LOK Company

Dept.H, 321 North Justine Street, Chicago 7, Illinois

"A simple operation and Punch-Lok puts your hose in use again," say Doc Punch and Mr. Lok. For complete product and price information, *see your near-by Punch-Lok distributor*, or write direct.

These Two Will Fill EVERY AIR HOSE JOB ...With Unequalled Reliability, Economy

"SUBWAY"®

For Rock Drills and Other Heavy-Duty Air Tools...

"Subway"...a Goodall *"Standard of Quality"* product... is built to assure uninterrupted delivery of maximum air power to the drills, even when the "going" is roughest. Light weight, flexible, easy to handle. Specifications include oilproof tube; highest quality wrapped duck carcass; wear- and weather-resistant red rubber cover, with new criss-cross yellow stripe for positive identification. Sizes ½" to 1¼", I. D., in maximum lengths of 50 feet.

"ALLSERV"

***General Purpose* HOSE**

For All Types of Pneumatic Tools—Also Water, Oil, etc.

"ALLSERV" will not only give long, reliable service on air and pneumatic tools, but will prove equally efficient in the handling of water, oil, gasoline, chemicals, paint spray, etc. It is a very flexible all-"Synplastic" (R) molded-and-braided hose, in one, two or three braid construction, with a tough wear-resistant red cover. Made in ¼" to 1½", for working pressures from 200 lbs. to 300 lbs.

Contact our nearest branch for details

"If it's GOODALL, it MUST be Good!"

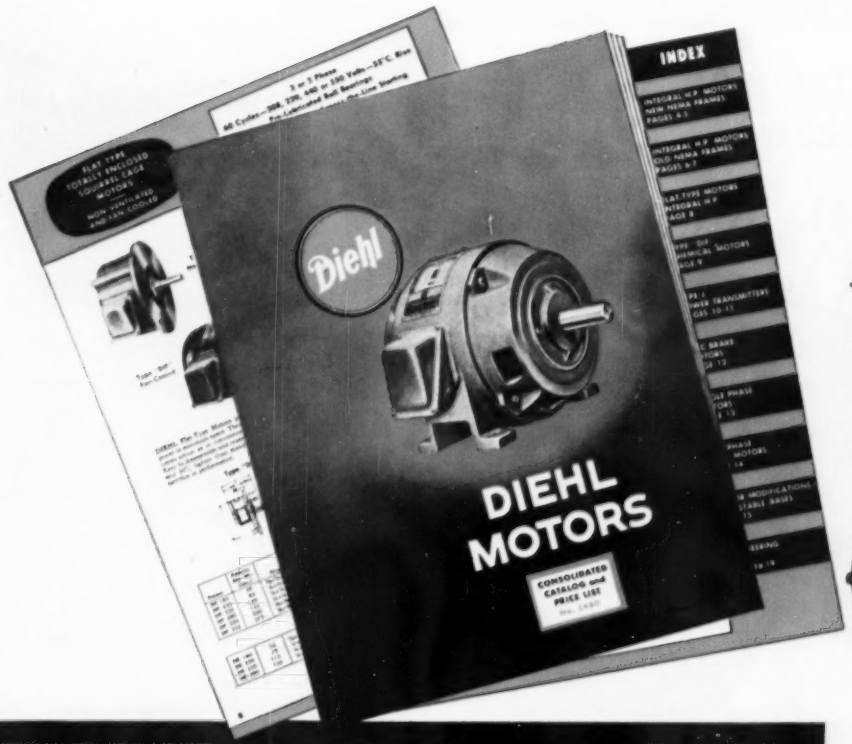
Standard of Quality—Since 1870 HOSE · BELTING · FOOTWEAR · CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL *Rubber Company*

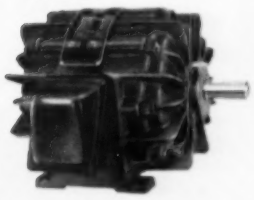
GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.
Branches and Distributors Throughout the United States and in Canada

Circle 30A on reply card

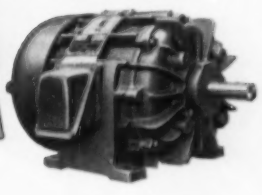
Circle 31A on reply card



Type "DIE" Totally Enclosed Motors (Non-Ventilated)



Type "DIF" Totally Enclosed Motors (Fan Cooled)



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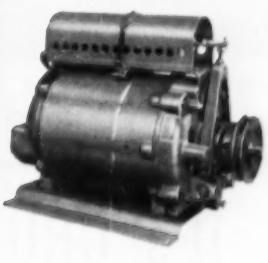
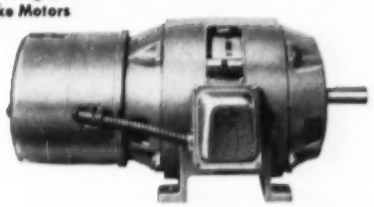


Type "DI" Magnetic Disc Brake Motors



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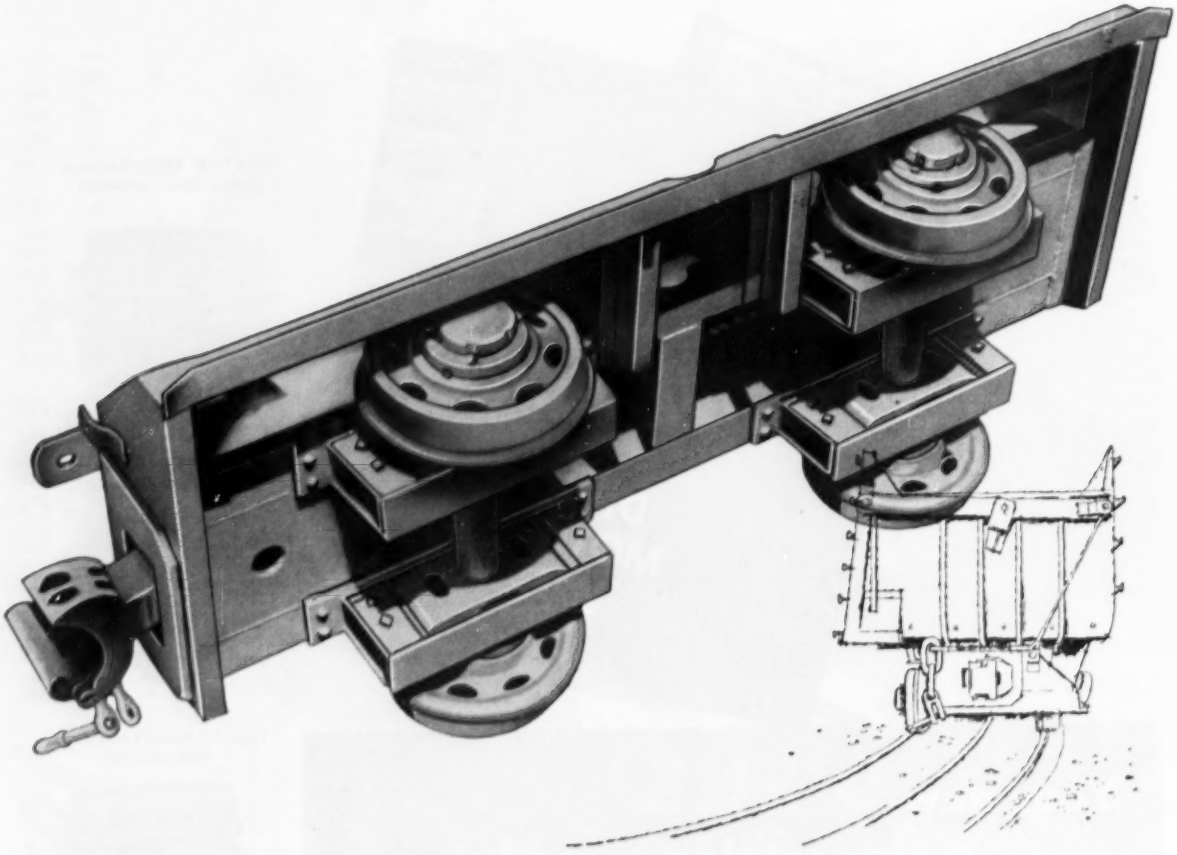

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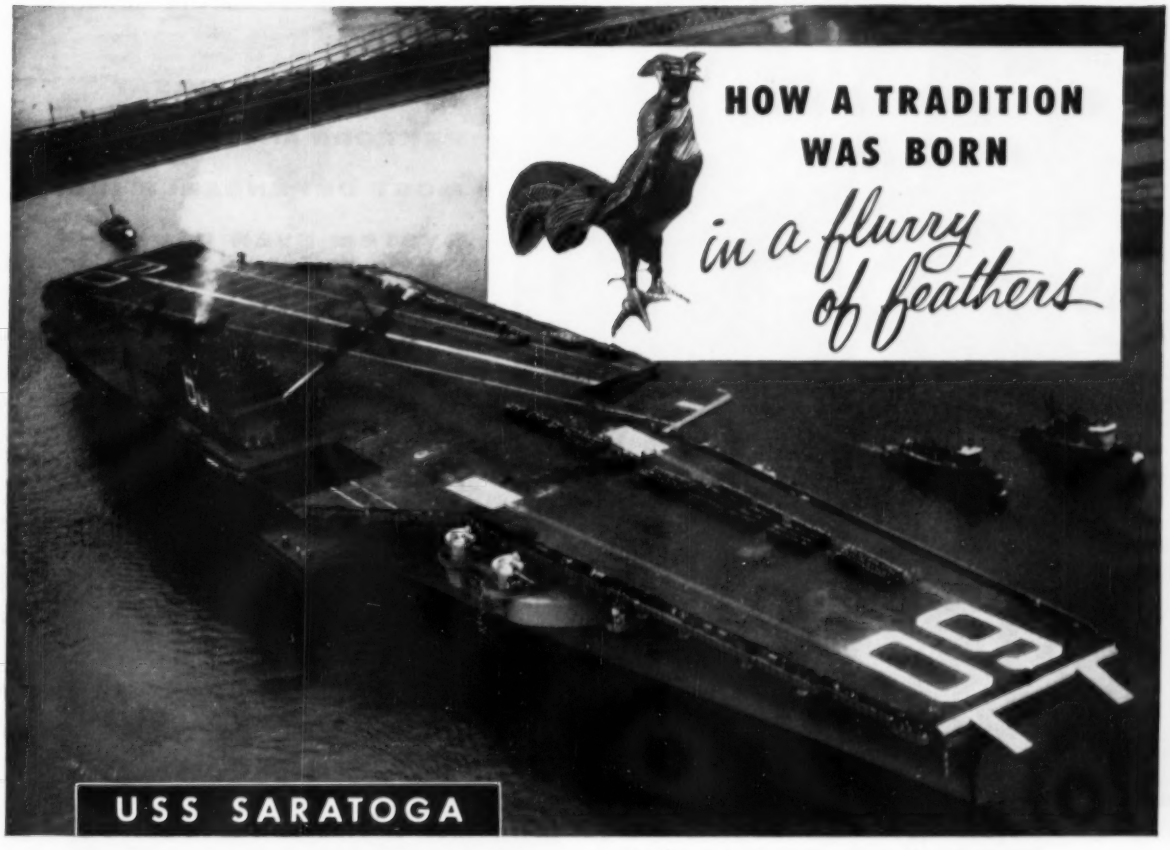

The symbol, and the spirit, of the fighting gamecock lives on with the commissioning of the powerful aircraft carrier, *USS Saratoga*.

The incident which gave birth to this 142 year old Navy tradition took place on the decks of the first *Saratoga* as she closed for action against four men-o'-war in 1812. In the opening minutes of the engagement an enemy ball landed on deck – crashing into a coop containing a gamecock brought aboard by a sailor.

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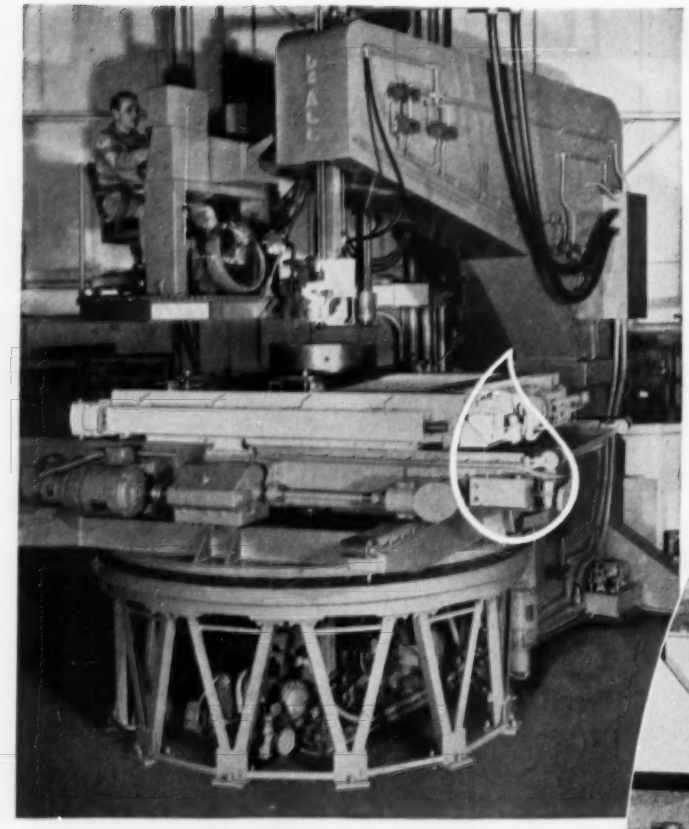

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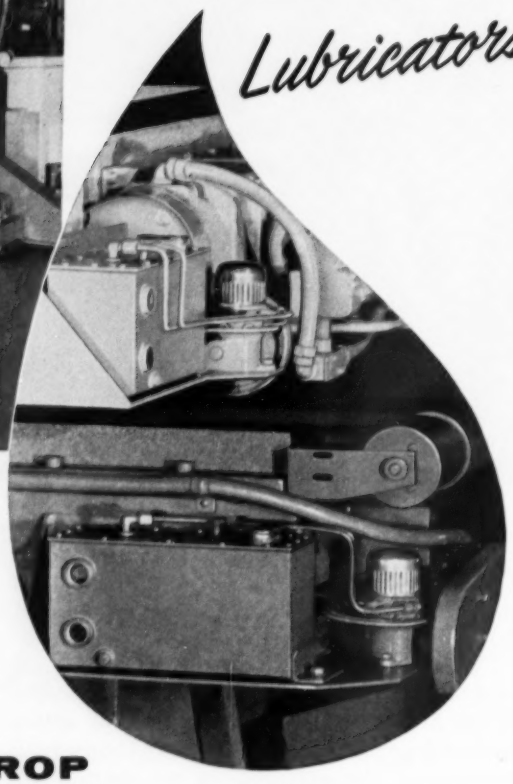

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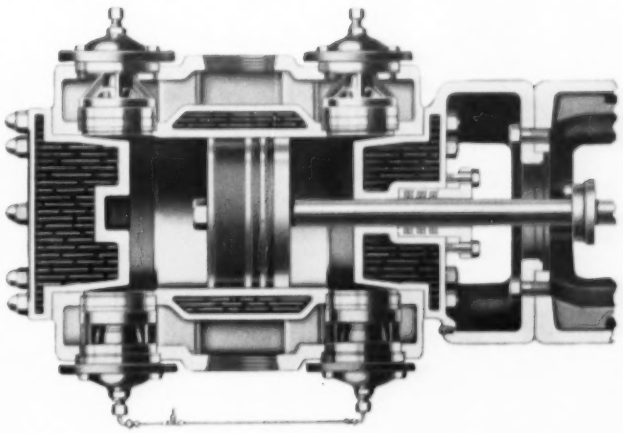
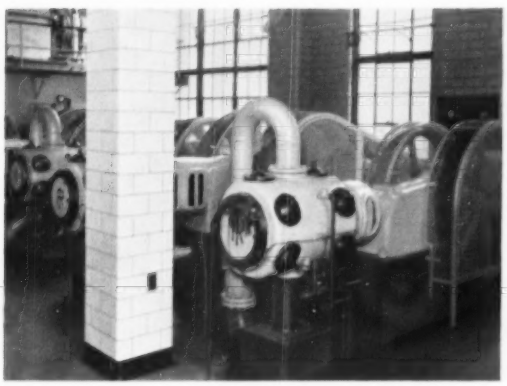
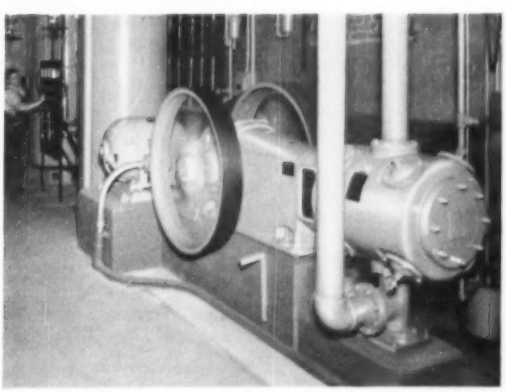




Installed in a large brewery in 1933, this Ingersoll-Rand ES-NL compressor was the first unit ever built with non-lubricated cylinders. It is still in daily service, providing the clean, oil-free compressed air which is vital to product purity. Three other ES-NL compressors, installed since then, are shown in the background.



One of four ES compressors with NL cylinders, supplying oil-free air in the manufacture of super-precision instruments and aircraft ball bearings.

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In process and manufacturing plants all over the world, the problem of oil contamination in compressed air and gases has been successfully solved by the application of Ingersoll-Rand ES-NL compressors.

The unique NL cylinder design provides compression without oil lubrication—through the use of graphitic-carbon wearing and pressure rings. The ability of these compressors to deliver clean, oil-free air and gas, in continuous, heavy-duty service, has been thoroughly proved in every field of application.

If you have an application where oil-lubricated compressor cylinders cannot be used, ask your Ingersoll-Rand representative about the ES-NL compressor, sizes 5 to 150 horsepower—other Ingersoll-Rand NL compressors to 1000 hp.

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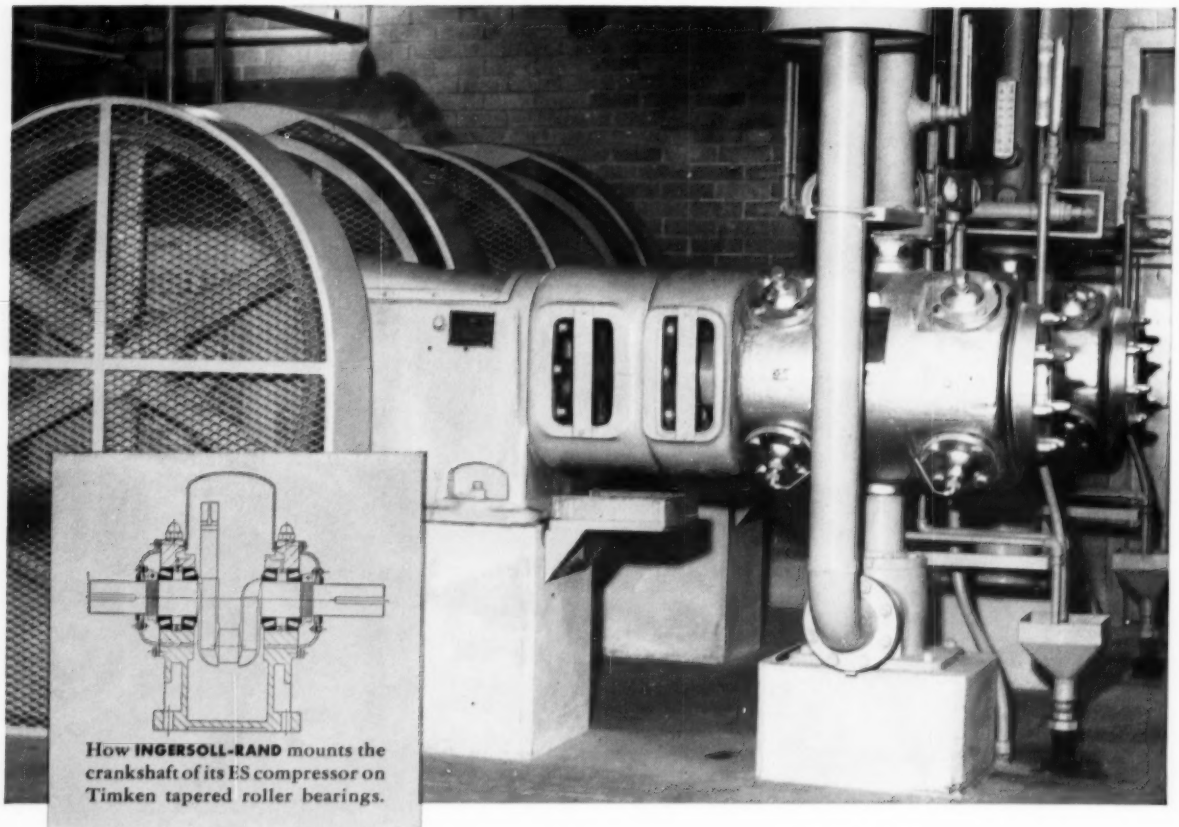

How **INGERSOLL-RAND** mounts the crankshaft of its ES compressor on Timken tapered roller bearings.

Supplies air for instruments, TIMKEN® bearings supply dependability

A STEADY supply of oil-free instrument air is assured by two of these Ingersoll-Rand ES compressors. One big reason is the Timken® tapered roller bearings on the crankshaft that prevent costly breakdowns and maintenance delays.

Because of their tapered construction, Timken bearings take radial and thrust loads in any combination. The crankshaft is held in positive alignment. Wear on moving parts is minimized. And Timken bearings keep housings and crankshaft concentric, making closures more effective. Lubricant stays in; dirt stays out, further reducing maintenance.

There's less power loss in the compressor, because Timken bearings make friction negligible. They're designed to give true rolling motion and precision manufactured to live up to their design.

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No other bearing can give you all the advantages you get with Timken tapered roller bearings. Make sure you have them in the machines you build or buy. Always look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

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The special grade alloy steel which gives Timken bearings their strength and resistance to wear is made in our own steel mills.

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